

AUTOMOTIVE INDUSTRIES

AUTOMOBILE

Vol. 66

Reg. U. S. Pat. Off.

Number 8

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Automotive Industries is published every Saturday by
CHILTON CLASS JOURNAL COMPANY

Chestnut and 56th Streets, Philadelphia, Pa.

C. A. MUSELSEMAN, President and General Manager
J. S. HILDRETH, Vice-Pres. and Director of Sales
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A. H. VAUX, Secretary and Treasurer
JOHN A. CLEMENTS, Asst. Treasurer
JULIAN CHASE, Business Manager
Automotive Industries
Cable Address Autoland, Philadelphia
Telephone Sherwood 1421

OFFICES

New York—U. P. C. Bldg., 239 W. 39th St., Phone Pennsylvania 6-0080
Chicago—367 West Adams St., Phone Randolph 9448
Detroit—710 Stephenson Bldg., Phone Madison 2090
Cleveland—110 Guardian Bldg., Phone Main 6860
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Los Angeles—Room 651, 1206 Maple Street, Phone Westmore 6477
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Controlled by United Business Publishers, Inc., 239 W. 39th St., New York:
ANDREW C. PEARSON, Chairman, Board of Directors; FRITZ J. FRANK, President;
C. A. MUSELSEMAN, Vice-President; F. C. STEVENS, Treasurer.

SUBSCRIPTION RATES: United States, Mexico, United States Possessions, and all countries in Postal Union, \$1.00 per year; Canada and Foreign, \$4.00 per year. Single Copies 25c.

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Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Automotive Industries

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February 20, 1932

Automotive Industries

Industry Awaits Zero Hour As Ford Rumors Are Blasted

by Herbert Hosking

BLASTING ground from under the rumors of the past few months, the preliminary announcement of the new Ford cars, made last week (Feb. 11), leaves for speculation only the important considerations of:

1. Price
2. Effect on the market
3. Dimensional details of the cars and
4. Actual date of the first showing.

On the positive side of the statement, issued as proceeding directly from the core of the Ford executive offices, the following points were made: there will be an eight-cylinder car with a V-type engine; there will be a four-cylinder improved Model A; the cars will be virtually identical except for the engine, offering in effect the same chassis with interchangeable engines; both cars will have roomier bodies, heavier frames, lower chassis, etc., than have yet appeared on a car bearing the Ford nameplate; 10 body types will be produced; production will begin some time in February, the first showing to the public to come early in March.

In addition to the above, Mr. Henry Ford clearly stated that both cars will remain in the low-priced field, fortifying this with the remark that he was returning to his old determination to get the price of an automobile down to the point where the public could purchase it in quantity.

Even though it contains the gaps indicated above, the statement makes it apparent that the zero hour for the 1931 low-priced-car market is rapidly approaching.

For many weeks Ford dealers all over the United States and Canada have had orders to clear stocks of Model A by the first week in March.

Several months have passed since it first became apparent that the Ford Motor Co. intended to introduce a new line. Even without official confirmation, the news had its usual unsettling effect on the low-priced car market. In a market which is generally dominated by the increased use of existing cars, rather than the purchase of new ones, the old cry of "wait for Ford" retains some of its magic, at

The New Ford

Looks

Astute observers see in the new British Ford midget (described in Automotive Industries last week) indications of Mr. Ford's thinking.

The tiny car has a radiator shell resembling this year's Lincoln "12."

Body lines slope rearward, has aerodynamic appearance, and a new visorless windshield.

The midget car is said to have a synchronizing-gear transmission, new for Ford.

Price

As indicated here, prices on the four-cylinder successor to the Model A may drop below \$400.

Assuming an eight-cylinder engine may be offered in the same chassis, the minimum differential between the cost of the four and the eight may drop below \$100, if the cars are similar.

When

Mr. Ford says the cars will be shown early in March.

the expense of other lines of cars announced earlier in the year, and Mr. Ford's preliminary statement has apparently fortified this position. There has been, of course, some similar repercussion in Ford's own sales. Even though it is generally understood that a new car is coming, no authority has been given

Production Figures of Ford Motor Co. Beginning of Model A Production

July-December, 1927, there was no production
1928 production got under way slowly

Jan.	6,000	July	65,000
Feb.	12,000	Aug.	91,000
March	18,000	Sept.	82,000
April	32,000	Oct.	105,000
May	45,000	Nov.	105,000
June	52,000	Dec.	110,000

Ford dealers to cut prices, and their clean-up problem has been difficult.

When the New York show opened Chevrolet and Willys-Overland were fortified with new models. Plymouth brought in the car which had been announced earlier in 1931. Prices on the three makes mentioned followed 1931 lines. Now, a month after the show, Willys-Overland has made a flat reduction in price of \$100 on all its types. Plymouth has introduced two supplementary "Thrift Models"—a two-door and four-door sedan, to sell substantially below the corresponding standard models.

Some of the tooling and development costs of the new Chevrolet have undoubtedly been already absorbed, it being understood in some quarters that a reduction in price of \$50 would push this absorption forward only a relatively short time. The assembly and manufacturing organization of Chevrolet is believed to be in extremely flexible condition for accommodating rapid changes in the mechanical specifications of the cars.

The new Ford car will not break on an altogether unprepared market, assuming a merchandising set-up following present lines. Recent authoritative information from Detroit, however, has indicated that there may be other considerations to be met. It has been rumored, for instance, that Mr. Ford intends to sell the new car for a down payment of \$50, with the financing extended over a two-year period. Critics of this possibility have pointed out that such a program would not necessarily increase the sales of cars, if the present strictness of credit qualifications were adhered to. Insecurity of employment among the low-income group to which the plan would appeal adds a potent hazard in the form of an increased and unprofitable repossession rate.

The writer believes, on the other hand, that such a plan would have a beneficial effect on Ford sales. The Universal Credit Corp. has offered an 18-month

financing plan for some time, with no indication of serious defalcations by purchasers, although the repossession rate is certainly higher than that for cars financed on standard terms. Extension of the terms for another six months would not seriously extend the financing period toward the end of the normal life span of the car. The down payment would be large enough, considering the price of the car, to constitute a respectable percentage of the depreciation for the first year, so that if it were necessary to repossess and resell the car, the loss would be minimized. Again it may be assumed that in extending payments over a two-year period Mr. Ford would have in mind the inevitable improvement in the business situation, which would naturally result in a diminishing repossession rate on cars sold in the present market.

Apart from consideration of this sort there is the ever-present possibility that the new Ford car may carry a substantial price reduction in its wake. The last Ford price reductions were made more than a year ago (Jan. 19, 1931). In the time intervening between then and now the index of automotive raw materials prices compiled for this publication has dropped about 10 points, or about 10 per cent of its position in last January.

It has been stated that in announcing the new car Mr. Ford plans, if it proves necessary, not only to write off tooling costs from the surplus account of the company, but to dip into his personal fortune to the extent of \$100,000,000 to put the new cars across. It is not conceivable that tooling costs alone would absorb the bulk of this immense asset combination. From this it may be reasoned that Mr. Ford is willing to absorb an expense on the new cars beyond the cost of tooling and merchandising. What may such a figure be, in terms of the individual unit?

The only available returns on the financial operations of the Ford Motor Co. during the past five years are as follows:

Year	Indicated Profit or Loss*
1927	\$42,786,000 loss.
1928	\$72,221,498 loss.
1929	\$44,460,823 profit.
1930	\$81,797,861 profit.
1931	Figure not yet reported.

* Figured by independent sources from rises and drops in the surplus account of the Ford Motor Co. submitted yearly to the Massachusetts Commissioner of Corporations. Does not include provision for any dividends which may be taken.

(Turn to page 252, please)

Vertical Price-Range Tabulation

Make and type of car	List Price*
Willys-Overland rdstr. (2-pass.)	\$415
Ford rdstr. (2-pass.)	430
Ford phaeton	435
Ford rdstr. (2-4 pass.)	455
Chevrolet rdstr. (2-pass.)	475
Ford Tudor sedan	490
Ford coupe (2-pass.)	490
Chevrolet spt. rdstr. (2-4 pass.)	495
Plymouth "Thrift Model" sedan (2-door)	495
Ford spt. coupe (2-4 pass.)	500
Chevrolet phaeton	510
Willys-Overland coupe (2-pass.)	515

Make and type of car	List Price*
Willys-Overland coach	\$515
Plymouth rdstr. (2-pass.)	535
Chevrolet coach (2-door)	545
Willys-Overland coupe (2-4 pass.)	545
Plymouth coupe (2-pass.)	565
Plymouth sedan (2-door)	575
Plymouth "Thrift Model" sedan (4-door)	575
Ford victoria	580
Ford sedan (4-door)	590
Willys sedan	595
Plymouth spt. rdstr. (2-4 pass.)	595
Ford conv. cab	595

Make and type of car	List Price*
Chevrolet coupe	\$595
Willys-Overland spt. rdstr. (2-4 pass.)	595
Plymouth coupe (2-4 pass.)	610
Chevrolet cabriolet (2-4 pass.)	615
Ford town sedan	630
Plymouth sedan (4-door)	635
Ford conv. sedan	640
Plymouth conv. coupe (2-4 pass.)	645
Chevrolet conv. phaeton	650
Chevrolet sedan (4-door)	650

*As of Feb. 15, 1932.

JUST AMONG OURSELVES

Fact and Theory Clashing Gears

"THE difference between the academic and the practical mind," said Bob Janeway of Chrysler in an S.A.E. session discussion a few weeks ago, "is this: When the facts developed by a series of tests do not agree with the theory, the academic mind tends to reject the facts; the practical mind tends to reject the theory."

The remark was interjected casually in a discussion of a highly technical matter, but we hope some day Janeway will elaborate it further. It might be the starting point for a mighty interesting article.

No mind, of course, is a pure "academic" type nor a pure "practical" type, but the mental processes of most of us lean rather strongly on one side or the other. Good balance between the two is needed if any given set of data is to be interpreted accurately.

Progress Demands Data and Ideas

THEORY, as such, can never properly be rejected, because sound theory, after all, is simply the correct summation and interpretation of many sets of factual data. Webster gives several definitions of the word "theory," but the one which seems to us best to apply to the present discussion runs like this: "An exposition of the general or abstract principles of any science."

If a particular theory runs counter to the logical summation of accurately compiled

facts, that particular theory certainly can and should be rejected. But if the facts are to serve their fullest purpose, they must be used as the basis for setting up a new theory in place of the old. Only in this manner can any given set of data be given its widest application and fulfill its widest usefulness.

And certainly it would seem to be sound business, in the case of any theory which past experience has indicated to be correct, to question first the method of compilation and accuracy of new facts which—if true—would upset the old theory. Only having proved the new facts, can the old theory properly be rejected.

Trouble is the "academic" mind too often rejects the facts simply because they don't coincide with the theory and is unwilling to do the work of examining their basis and the extent of their accuracy. And, by the same token, the "practical" mind too quickly rejects even well-established theories when a new set of what looks like facts seem to contradict it.

Under-side Streamlining

SIR DENNISTOUN BURNEY doesn't think it worth while to fair the under-side of streamlined automobiles. His experiments, he told the S.A.E. crowd in Detroit, indicate that such practice adds unnecessary expense and weight which far outweigh the slight advantages gained through reduction in wind resistance. It is sufficient

for all practical purposes, he indicated, simply to smooth off as many projections as possible.

The Dollar Rate Widens Service

A FEW weeks ago the subscription price of *Automotive Industries* was fixed at \$1 instead of \$3, thus giving the publication greater opportunity to fulfill its widest functions during a period of business depression.

As we traveled about through the industry, it became more and more apparent during these last 12 months that many executives, engineers and production men who wanted their own copies of the publication and who needed them worse than ever before were being hindered from starting or renewing personal subscriptions because of price. We found scores ready and eager to pay a dollar to whom three times that amount seemed too great under present conditions.

Despite the fact that the circulation of *Automotive Industries* had increased steadily for many weeks prior to the reduction in subscription price, our investigations made it apparent that the publication could not render its widest service to the industry if the higher price were maintained during the depression.

Editorially, the job of this publication, of course, is to serve effectively as many as possible of the selected group of automotive factory men which comprises its possible readers. We found that we could do that better with the lower subscription price. But the subscription list will still be definitely confined to those affiliated with the executive, manufacturing and engineering phases of the industry.

Continued improvement in the vigor and quality of editorial content is planned as a concomitant.—N.G.S.

Stratosphere Adventures Are Intriguing Engineers to Design Super-Speed Craft

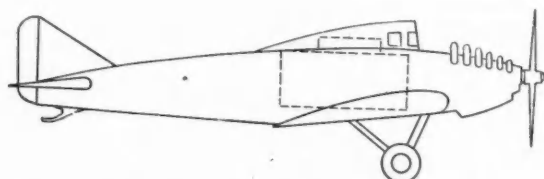


Fig. 1—Farman stratosphere plane built for the French Department of Air

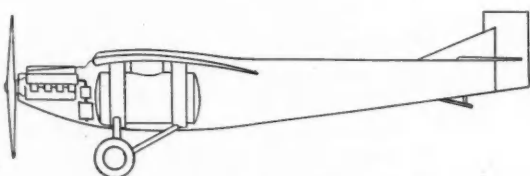


Fig. 2—Guerchais stratosphere plane

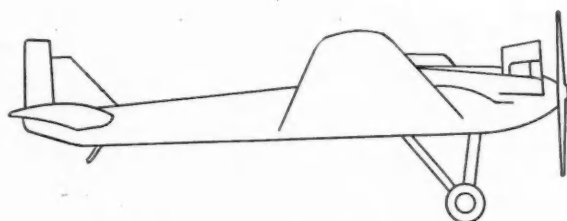


Fig. 3—Junkers stratosphere plane

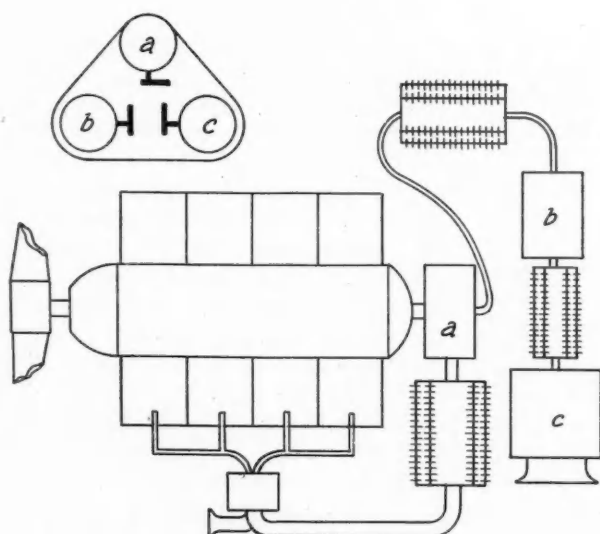


Fig. 4—Diagram showing arrangement of superchargers on Farman plane. (Sub figure in upper left-hand corner shows correct relative location of superchargers)

EVER since superchargers were first applied to airplane engines, there has been interest in flights at high altitudes, or in the stratosphere, which begins at about 40,000 ft. At that altitude the atmospheric density is only about 19 per cent of what it is at sea level, and the resistance to the motion of a plane through it is proportionally reduced. Recently active work on machines adapted for the purpose has been started.

Although quite high altitudes have been reached repeatedly, in practically every case the object has been to establish a new altitude record, rather than to take advantage of the low air resistance to cover long distances at high speeds.

The successful balloon ascension into the stratosphere by Professor Piccard of Brussels, who reached an altitude of more than 52,000 ft., and the offering of a trophy by the famous French aviation pioneer, Louis Bleriot, to be known as the 1000-kilometer cup, which is to be awarded to the man who first succeeds in attaining a speed of 1000 kilometers (or 622 miles) per hour, have intensified interest in altitude flying. So far as can now be foreseen, there is little chance of attaining this terrific speed except in the rarefied atmosphere of the upper regions.

Active work on the problem of flight through the stratosphere is said to be in progress in France, Germany, Russia and Italy. We find an account of the French and German efforts in *La Technique Moderne* by M. Francois Baudot.

The French Minister for Air has ordered a Farman machine as a prototype of this class of plane; its construction has been practically completed and tests with it are to be begun immediately. The design of the plane is based on that of the standard Farman 190, the chief difference being that the wing area has been increased from 485 to 646 sq. ft.

A closed cabin was built into the fuselage at the center of sustentation. This cabin is equipped with all of the apparatus necessary for the respiration of the occupants, such as bottles of air and oxygen with their pressure reducers, apparatus for the absorption of carbonic acid gas, heating apparatus, altitude and pressure recorders, instruments for blind flying, and all of the usual engine and accessories control devices.

The landing gear was increased in height, so as to permit sufficient clearance for the propeller, which is of larger diameter than on the standard machine. It is a four-blade propeller of 13-ft. diameter and of the variable-pitch type. All of the control surfaces of the plane were increased in the same proportion as the lifting surfaces.

Most of the effort was devoted to the engine, which was designed for operation at an altitude of 65,000 ft.

by P. M. Heldt

Review of European work indicates vast amount of development on power-plants, propellers and fuselage is in progress now overseas

It is an eight-cylinder, water-cooled, inverted V type. Interest centers principally around the supercharger, which was worked out in collaboration with the Rateau compressor works, who have long specialized in superchargers for airplanes. The equipment comprises three compressors, *a*, *b* and *c*, which are arranged so their axes form the points of a triangle, as illustrated by the sub-figure in Fig. 4.

Up to an altitude of 13,000 ft. the engine works without compressor, air then being taken into the carburetor directly from the atmosphere. When this altitude is reached the first compressor, *a*, is engaged by the pilot by means of a friction clutch, and simultaneously the direct inlet to the carburetor is shut off by means of the valve *F*. The engine is operated in this way until an altitude of 26,000 ft. is reached, when the second compressor, *b*, is started, also by means of a friction clutch.

Finally, at 46,000 ft., the third compressor, *c*, is started, and all three compressors then work in series. There is an inter-cooler between *c* and *b* and another between *b* and *a*, and there is an after-cooler between compressor *a* and the carburetor. The whole arrangement is shown diagrammatically in Fig. 4.

This arrangement, M. Baudot points out, is the opposite of that which was chosen for the racing seaplane Radium built in France for the Schneider cup race

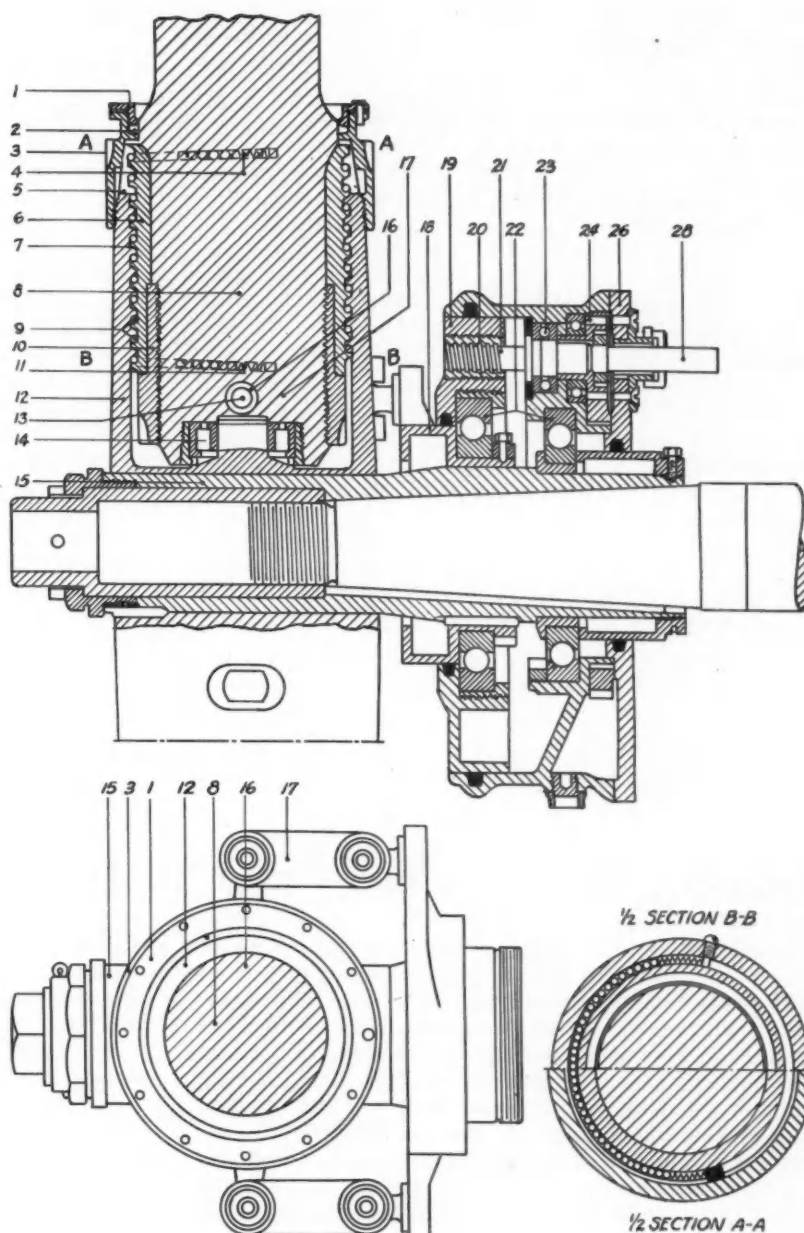


Fig. 5—Mechanism for varying pitch of Ratier variable-pitch propeller

1, Gland nut; 2, Packing felt; 3, Jam nut to take up play, compressing the tapered, slotted end of hub 5, which latter is provided with saw-tooth shaped threads on the inside; 4, Upper spring serving as stop for the steel balls; 6, Ferrule for root of blade, of nitrided steel, with saw-tooth external thread; 7, Key; 8, Metal blade; 9, Steel balls between the screw threads of parts 6 and 12; 10, Lock nut for ferrule; 11, Lower spring stop for steel balls; 12, Hub of nitrided steel, with internal saw-tooth screw thread; 13, Socket for pin 16; 14, Roller-guide bearing for root of propeller blade; 15, Hub sleeve; 17, Link pivoted to pin 16; 19, Sliding disk provided with three bronze sleeves 20, secured into the disks by means of external screw threads and provided with square threads on the inside; 22, Deep-groove ball bearing; 23, Ball thrust bearing; 24, Small toothed pinion keyed to pitch-control shaft 28; 25, Spur gear meshing with pinion 24 and driving two other pinions like 20 not shown in the drawing, which operate screws in threaded sleeves similar to 20; 26, Cover plate for the stationary housing; 27, Packing felt between stationary and movable parts; 28, Control shaft of pitch-changing mechanism.

from designs of M. Barbarou, chief engineer of the Loraine company. This supercharging equipment, which was also due to the Rateau firm, had the carburetor mounted ahead of the compressor, which latter therefore compressed combustible mixture. In this case the carburetor is subjected to the pressure of the surrounding atmosphere, while in the Farman stratospheric plane it is subjected to super-pressure.

A four-bladed metal propeller is being used. The hub of this propeller, which is a steel forging, contains a mechanism for varying the pitch of the blades with an increase in altitude.

M. Guerschais, an engineer who was formerly connected with Farman, has designed a plane which is intended for practical use in the lower parts of the stratosphere, rather than for scientific exploration of the upper stratosphere. It is said to be the intention later to fit this plane with Makhonine variable surface wings, from which a material increase in speed is expected.

The machine is a monoplane of the thick wing type, the section of the wings decreasing toward the tips. The wing area is 485 sq. ft. The fuel supply carried is sufficient to keep the engine going for 15 hours

and to cover a distance of 3700 miles, it is figured.

The engine is an 18-cylinder Loraine Orion of 4.92 in. bore and 7.09 in. stroke (2440 cu. in. displacement). It is of the water-cooled type and is fitted with a reduction gear. The weight is given as 1250-1580 lb.

Charge is supplied to the cylinders by nine carburetors, whose automatic feature is based on the principle of the submerged metering nozzle.

A Brown-Boveri three-stage supercharger is used, and is located at the forward end of the engine, being driven directly from the crankshaft through a friction clutch. Its rotor revolves at 11,000 r.p.m. Up to an altitude of 10,000 ft. the engine draws in air directly through the carburetor. Then the direct air intake is closed and the supercharger is engaged by means of the friction clutch. At first the supercharging effect is reduced by means of a gate valve at the supercharger inlet, which is gradually opened by the pilot as the altitude increases. It is claimed that by means of the supercharger the engine power can be maintained at its ground value up to an altitude of 49,000 ft.

Since with increase in altitude the atmosphere be-
(Turn to page 264, please)

Industry Awaits Zero Hour as Ford Rumors Are Blasted

(Continued from page 248)

The drops in surplus account in 1927 and 1928 represent, from the production standpoint, a complete blank from July-December of 1927, and marginal production during the early months of 1928. In 1929, in common with the rest of the industry, Ford reached peak production figures, as the accompanying tabulation indicates. Grouping the indicated Ford profits (gains in surplus) for the years 1929 and 1930, the resulting figure is \$126,258,684. Total production of Ford vehicles during the same period was 3,451,092 units, according to the best available estimates.

The combined production and profit figures for the two years give a rough-average indicated profit per unit of \$33. This figure, because of the immense overhead of the Ford organization, drops in years which do not give better-than-marginal production figures.

In spite of his more recent maneuvers into the field of quality appeal, price (and that means minimum price) has always bulked large in Mr. Ford's thinking. Assuming that he is willing to assume additional expenses (beyond the usual expenses in connection with new model development), reference to the accompanying table of price ranges will show that it is possible for each of five popular types of the Ford car to drop below the \$400 f.o.b. mark, keeping in mind the reduced cost of raw materials.

The increased production which would result from such a move would partially compensate for the direct loss, and the time necessary for a complete write-off of all expenses incurred might not be substantially longer than it would be under a set-up comprising present prices and new models.

No matter what slashing reductions in price may

be made, the effect on the remainder of this year's market will probably be negative rather than positive, considering total sales in the low-priced car field. Unless the Ford organization has accomplished hitherto undreamed-of feats in getting production under way it will be many months before it can satisfy maximum demand. In 1928, following the introduction of the Model A, it was 10 months before production reached 100,000 per month. Any figure substantially below this would not give Ford his normal share of the market, even in this year 1932.

On the other hand, if a price cut figures in the announcement, sales of other cars in the low-priced field are bound to be harder to make, even though Fords enough to meet the demand cannot be obtained. On the basis of the 1928 figures it would take the production figures of three months to adequately stock existing Ford dealers.

But a financing plan such as the one discussed earlier, which would guarantee eventual actual delivery of a Ford car upon down payment of a sum of the order of \$50, might possibly, from the Ford standpoint, prove an ideal antidote to the growing pains of early new model production. The reaction following the national automobile shows has indicated that buyers will wait a little longer. The General Motors sales figures announced last week showed the effect of this, as did the stock market the following day, when motor stocks were hard pressed to meet a bearish tendency, apparently hinging on the General Motors figures, combined with the less substantial stuff of the rumor that Ford intended to crack open the market with price cuts. Everything points to the fact that buyers will wait.



Standard Kellett autogiro with hood in position

Kellett Designs Detachable Hood for Open-Cockpit-Type Autogiro

TO add to the comfort of pilot and passenger in cold and inclement weather, the Kellett Aircraft Corp. of Philadelphia has recently developed a convertible cabin-type autogiro. It consists essentially of the standard open-cockpit autogiro provided with a detachable hood. The top is secured to the fuselage in a very substantial manner by bolts, and it is not intended to be raised and taken down with changes in the weather from day to day, but rather to take care of seasonal changes. The cabin is well ventilated and the top affords good vision in all directions.

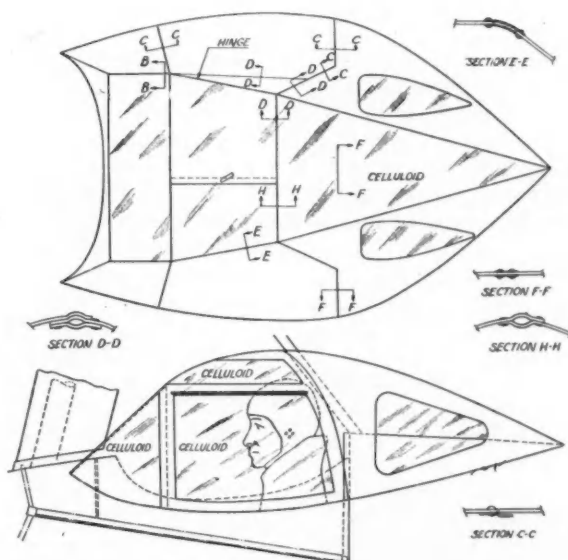
The design of this removable top presented a number of problems. In an autogiro, free vision in every direction is highly essential, for while an airplane must always be traveling forward at considerable speed while in the air, the autogiro can hover in the air and descend vertically, so it is important for the pilot to know what is going on behind and below him. It is, of course, also essential that the top be light and able to withstand the stresses due to air resistance, hence it is built of sheet and strip aluminum and pyralin.

The forward wall of the cabin is formed by the windshield, which slopes sharply. On the left side, adjacent to the pilot, there is a window which can be opened while in flight for ventilation. It is hinged

at the top and is provided with a control mechanism pivoted to it at the bottom, which comprises a handle and a pair of jack-knife links having a stationary hinge support on the bottom edge of the window frame. When the window is open the jack-knife links are extended and slightly beyond the dead-center position, so it is held open positively. To close the window, the pilot grips the handle and moves it in a circular path around the pivot-joint on the window sill through nearly three-fourths of a circle, until it lies close against the cabin wall on the inside. In this position the window is held closed firmly.

On the opposite side there is a door, which is in two sections hinged together on a horizontal line. The lower edge of the door is hinged to the cabin wall and at the top edge there is a lock which can be operated by handles from both the inside and the outside. When the door is being opened it swings around the hinge at its lower edge, and when open it lies close to the outer wall of the fuselage.

To secure the necessary stiffness in the metal structure of the top, a corrugation is run close to each edge, the corrugations in parts riveted together being in opposite directions, so that a hollow section of considerable stiffness is formed



Plan and elevation of the Kellett hood

Despite Low Tonnage, Nickel Alloys and

Research effort achieved brilliant results which will be exploited when business swings back to normal levels



by Robert C. Stanley

President, The International Nickel Co. of Canada, Ltd.

ALTHOUGH the nickel industry has shared the world-wide disappointments caused by the delay in business recovery, developments during the past year indicate a continuing growth of diversity in uses, which will be marked as business steadily works its way back to normal volume.

One of the year's most important developments in nickel plating began under the auspices of the research committee of the American Electroplaters Society, in a program of exposure tests and the development of standardized specifications for plated products and for raw materials.

Nickel plating in solutions of low Ph. (high hydrogen ion concentration) is being used successfully by a large automobile producer in many of its plants. This bath is more acid than that commonly employed, permits plating faster and makes more production possible from a given amount of equipment, the resultant plating being much more resistant to corrosive attack of the base metal underneath it.

Chrome Plating Provides Market for Nickel

While competitive in one sense, chromium plating is maintaining a market for nickel, as the chromium finish is most successful where it has been plated on a comparatively heavy nickel plate as base.

The serious curtailment in automotive production directly affected the demand for nickel steels of varying nickel content, as these steels have become standard for various parts of pleasure cars, buses and trucks. Despite this drop in tonnage, there has been

an increase, rather than a diminution, in the applications of nickel steels, and the recovery of automobile production will find this field a more important market for nickel than ever.

The use of nickel steels for chisels and battering tools is little known, although a number of firms have used it for years in punches, chisels, rivet sets, etc. Now, by the development in England of a special heat treatment, the successful application of this material has been extended.

The success of S.A.E. 4615 steel containing 1.75 per cent nickel and 0.25 per cent molybdenum has led to the development of a new steel with higher properties containing 3.5 per cent nickel and 0.25 molybdenum. This material looks promising for use in heavy-duty gears.

Ni-Resist, a corrosion-resisting cast iron, containing 14 per cent nickel, 6 per cent copper and 2 per cent chromium, has expanded considerably in its use both for corrosion resistance and as a mild heat-resisting material. It is used as a heat-resisting material for temperatures up to approximately 1500 deg. Fahr., and has shown wide expansion during the past year for annealing lehrs, automobile exhaust manifold by-pass valves, melting pots and cyanide pots. The last item is of particular interest, as pots of this material are showing five to 10 times the life obtained from plain iron or cast steel pots.

During the past year it has developed that a cast iron containing from 20 to 30 per cent nickel and about 2 per cent chromium shows very high resistance to caustic corrosion and is readily machinable. This alloy is classed as a Ni-Resist.

The use of nickel heat-treated cast-iron dies showed a marked expansion during the year. Use of these dies is for forming automobile bodies and radiator shells. The compositions used varied over a wide range. The one which has found the widest application contains from 2.5 to 3 per cent nickel, combined with 0.6 to 0.9 per cent of chromium. When heat-treated by quenching in oil the dies have a Brinell hardness of 300 or over. They can be finish-machined at this hardness. These dies have shown as high as 10 to 12 times the life of similar dies made of plain iron,

Plating Processes Gained Momentum in 1931

and in some cases have even exceeded the life of hardened tool steel dies. They have a further advantage over tool steel or other die materials, in that they are free from galling, especially with such metals as Monel metal and stainless steel. For extra heavy-duty work a number of dies have been made, either containing 5 to 6 per cent nickel and no chromium, or being alloyed with about 1 per cent chromium.

The use of nickel cast iron for brake drums has shown wide expansion during the past year. While its use was formerly confined mostly to trucks and buses, this past year has seen its adoption on a number of high-speed passenger cars.

It has been found that a cast iron containing 34 per cent of nickel and 3.5 per cent of chromium has about half the coefficient of expansion of plain iron. This property is being taken advantage of in molding dies in which the sections are subjected to different temperatures, in frames for gages, and in machine tools of high accuracy.

The use of nickel-chromium cast iron has been pretty well established for several years. The success of this material has led to investigation of the effect of other alloys in combination with cast iron. A promising mixture has been found containing nickel and molybdenum. A mixture of 2 per cent nickel and 1 per cent molybdenum shows unusual tensile strength and toughness; but this is an expensive mixture, and lower alloys containing 1 per cent nickel and from 0.35 to 0.50 per cent molybdenum are finding applications in cylinder blocks, brake drums and other wearing parts. The addition of 35 points of chromium to these mixtures is beneficial in increasing the hardness of heavy sections.

Alloys for high initial permeability of particular interest in communications work have been emphasized by the Bell Telephone Laboratories, and the more



standard alloys of the 50-50 nickel-iron type have become available to designing engineers for various classes of instruments for magnetic shielding and for small transformers for radio, airplane and marine use where saving in weight is important. The magnetic alloys were developed to a better available commercial position and are now being supplied regularly by several steel companies in the form of strip, sheet, rod, wire and stamped laminations.

The development of high strength Monel metal forgings, in conjunction with availability of particularly high strength Monel metal spring wire, interested engineers in the availability of this corrosion-resistant material for engineering applications where strength is important.

Marine Field Expands Use of Monel

In 1931 a special Monel metal spring wire was developed. It has a higher spring quality and can carry a greater load.

Two important developments in the marine field during the past year have been an increased use of Monel metal for the propellers of small and medium-sized craft, and an increasing use of nails of this alloy for fastening wood planking to boat hulls.

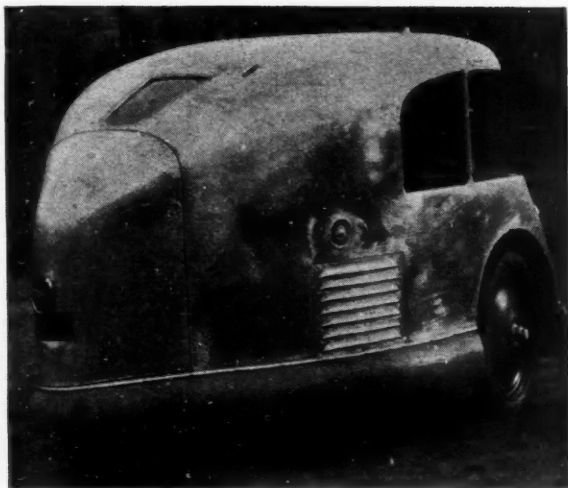
Two important steps were taken during the year to improve the conditions under which nickel and Monel metal welding is carried on. At our laboratory at Bayonne, N. J., there has been developed the "T" nickel welding wire through the control of the elements which influence fluidity, porosity, strength and deoxidation. Reports from the field are that this wire is giving consistently good results in both gas and electric welding.

To do satisfactory electric welding on Monel metal, nickel or nickel clad steel, it is necessary to have the welding rod properly coated with a flux to make for arc stability, fluidity and deoxidation. Both the nature of the flux and the manner of its application are important factors. Hence the company is now producing under its own control and supervision a satisfactorily coated wire for electric welding.



Rear Engine-Mounting and Streamline Adapted to Small Cars

by Herbert Chase



Three-quarter rear view of the three-wheeler. The four-cylinder Austin engine is mounted transversely back of the louvers and drives by chain to the single rear wheel

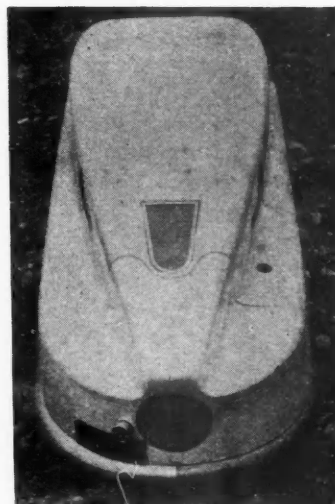
TWO highly original cars with engines mounted in the rear were shown publicly for the first time during the New York Automobile Show. They were experimental models, developed and built by James V. Martin of Garden City, N. Y. From an engineering standpoint the cars are noteworthy, not only because they involve placing the engine in the rear, but because they combine in a road vehicle many features characteristic of airplane design.

Although many automobile engineers doubtless will question the feasibility of many items in the design of the cars here described partly because they depart so far from conventional practice, it will hardly be denied that they merit study as representing a novel approach to problems that are coming more and more to the fore in the automobile engineering field.

Both cars have the same wheelbase and incorporate many of the same features of design. One is a four-wheeled, four-passenger type, the other a smaller and lighter three-wheeler having a single wide seat for two passengers. Both

Two Martin streamlined cars with rear engine mounting

Right — Rear view of the four-wheel car. Note the streamlined superstructure and the buffer strip which runs around the car

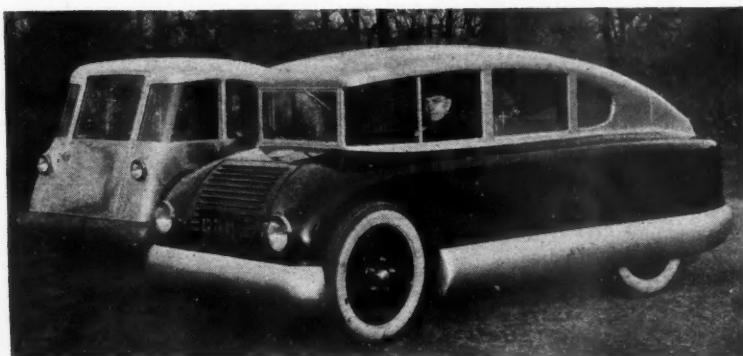


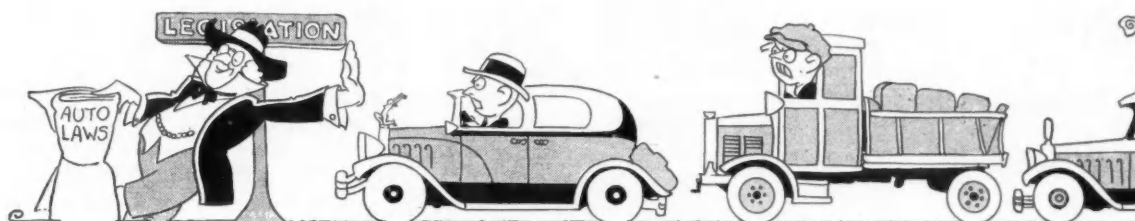
cars are equipped with small four-cylinder engines and have independent wheel suspension by rubber cord.

Considering first the four-wheeled car, it will be seen from accompanying illustrations that the passenger compartment is between the front and rear wheels, whereas the powerplant is entirely aft of the rear wheel axis. Both seats and powerplant are carried on a platform. This is a comparatively light structure built up from "metal-wood," a material involving plies of wood cemented to a layer of fabric, which in turn is cemented to sheet aluminum. The platform is only 4 in. deep; its top and bottom sheets are secured to longitudinal strips of metal-wood, and form a duct through which air from the radiator at the front is carried to the engine compartment in the rear. From the latter the air is expelled by a fan in a shallow shroud at the extreme tail end of the vehicle.

The center section of the platform has a width equal to the distance between the outside faces of the tires, or approximately 53 in., as the tread is 48 in. Between wheels it is narrowed. Except for a slight upward slope aft of the rear wheels, the underside of the platform is smooth and flat and clears the ground by 9 in. This minimizes interference or eddying of the air-

(Turn to page 267, please)





Legislators Seek State Funds For Budgets From Motor Vehicles

by A. Burdet Crofoot

WITH the ink hardly dry on new laws written into the statute books last year, legislators of a number of states are already busy this year grinding out new laws, many of which, if passed, will be pernicious in effect.

The most noticeable tendency in the legislation introduced so far this year is to increased taxation, especially for commercial vehicles. These bills have taken various forms, and many of them call for increased gasoline taxes as well. One bill, introduced in Massachusetts, calls for the tripling of fees charged under the existing law and raises the gas tax from three to five cents a gallon, the additional revenue thus derived to be used to set up a state-operated fund to be administered by a new body in place of the present compulsory insurance commission. Another Bay State bill would add three cents a gallon to the gas tax for use as a liability insurance fund to replace the compulsory insurance law now in force, and still another advocates a two cent increase without specifying the use to which it would be put.

Mississippi has a bill for a one per cent sales tax on vehicles carrying property or persons for hire, and another bill calling for a mileage tax of one-quarter cent to one cent on buses and one-half cent to two cents for trucks. This second bill would also permit incorporated cities or towns to charge a privilege tax of \$25 to \$200, according to the population of the city, for transportation companies operating in or through the city. Another bill in this state would again place a mileage tax of one-half cent to two cents for buses and one-half cent to five cents for trucks, while still another bill calls for a cent-and-a-half increase to the present five-and-a-half-cents gas tax.

New York has a bill which calls for increased registration fees which would not be very much higher for private passenger vehicles, but on the heavy trucks would practically multiply the existing rate by four.

This bill also calls for the doubling of the present gas tax of two cents a gallon. Another bill in this state would place an extra tax on vehicles operating for hire and would also tax interstate vehicles entering the state.

South Carolina would permit municipalities of over 500 inhabitants to license trucks and buses operating for hire through them at a *minimum rate to be determined by the railroad commission.*

Seeks Complete Revision

Virginia has a proposed law for the complete revision of the motor vehicle law, based generally on the uniform code, but calling for a radically higher scale of rates for commercial vehicles. The gross income tax now levied by that state would be raised from one and one-half per cent to five per cent under the proposed law for buses. The proposed scale for trucks and trailers, graduated by weight up to 40,000 lb., goes as high as \$1,195 with pneumatic tires. With solid tires, two dollars a ton gross weight would be added to this. Truck-tractors or semi-trailers would pay two-thirds of these fees, but every truck, trailer or semi-trailer operating for hire, except those with a "C" certificate (which are regulated), would pay *double these fees.*

Furthermore, this bill as worded gives rates for various gross weights "or less," which if strictly interpreted would mean that the half-ton truck would pay the full \$1,195 fee. Another bill introduced in this state would also increase the gross receipts tax for buses to five per cent, and would include the class "C" vehicles in the above fee scale. These vehicles under this bill would also have to pay the five per cent gross receipts tax.

Then, too, of course, we have the proposed excise tax under consideration in our Federal Congress, against which the industry has already become thoroughly aroused.

There is also some tendency this year toward diversion of motor vehicle revenues to other than state or county highway purposes. Thus Massachusetts proposes to allow gasoline distributors a two per cent reduction in taxes to compensate them for the collection

of these taxes. Mississippi will, if it passes one of the bills now under consideration, permit counties to use 50 per cent of their revenues derived from gas taxes for turning over to municipalities to pave their streets and meet charges on street bonds. New Jersey would also increase the distribution of moneys derived from this source to municipalities for local purposes.

Sizes and Weights Hit

Another tendency noticeable in many states this year is an effort to reduce further the permissible sizes and weights of vehicles operating over their highways. This, of course, again affects commercial vehicles only. Kentucky would limit gross weights per unit to 13,000 lb., prohibit trailers, and limit the length of semi-trailers and their drawing vehicles to 30 ft. Single units would be limited to 25 ft. in length, and maximum height would be 11½ ft. This bill is drawn on the expressly stated policy that trucks should be limited as they increase the cost of maintaining the highways and constitute a source of greater danger than do the private passenger vehicles.

Massachusetts would limit the capacity of trailers to one ton. New York would limit the gross weight of any unit to 10 tons, and Virginia would limit trailers to 14,000 lb. gross weight and 30 ft. in length for a single unit. Combinations would be limited under this proposed law to 50 ft. in length.

Regulation of commercial vehicles in one form or another is coming in for consideration this year in a number of states also. Thus Kentucky has a bill calling for regulation of all carriers of property or passengers for hire, and again increasing the taxes on this type of vehicles. Massachusetts has two bills, one calling for regulation of passenger and property carriers for hire, and the other requiring permits for this type. One of Mississippi's tax bills already discussed also calls for the regulation of for-hire vehicles, and there is a temporary notice filed in the house in Virginia which would permit the city of Alexandria to regulate carrier trucks operating through it.

In addition to the attempts being made in Massachusetts to set up special funds to replace the existing compulsory insurance law, which have already been mentioned, this state has a number of bills for the

amendment of the existing insurance law or otherwise setting up special funds for the state operation of this law. New York has a compulsory insurance bill and another which would provide that the defense of "contributory negligence" cannot be used by a defendant in any action for personal injury or property damage arising from a motor vehicle accident unless he can prove that he had liability insurance in force at the time of the accident, taken out prior to that time. In similar connection Virginia would provide for the suspension of the driver's license for failure to satisfy a judgment, thus virtually placing the state in the position of a collection agency.

Ask for Governors

Kentucky would require a governor on all types of commercial vehicles and Massachusetts has a similar provision under consideration for buses of over ten-passenger capacity. New York would require all trucks operating over a radius of more than fifty miles to carry two men, at least one of whom must be a licensed operator, the other one preferably to be licensed. Whenever the truck should stop one man would have to go out behind the truck with a red lantern and a flag and wave whichever one the time of day calls for until the truck should be ready to start up again. Another bill in this state would permit any state commission to establish speed limits. Kentucky would create a registrar of drivers' licenses as a state official who must personally fill out all such licenses and see that they are signed by the licensees in his presence. Another bill in this state would provide for the revocation of drivers' licenses on conviction of any violation of the motor vehicle law. Still another one calls for physical examination of all bus drivers and places their license fees at eight dollars a year.

At no time can the automobile industry look with indifference at attempts to hedge the operations of its customers to such an extent as to jeopardize the utility of the motor vehicle and the possible sales of the manufacturer. But this year, when every sale means so much more than usual to the industry and to the country at large, it is particularly important that every effort be expended to prevent the strangling of the use of automobiles and trucks to the point where it can no longer be profitably done.

Suggested for Safety in Driving

Editor, AUTOMOTIVE INDUSTRIES:

As a reader of *Automotive Industries* and automobile owner, permit me to make two suggestions that might help to reduce automobile accidents.

Rear-end collisions at night are frequently caused by the obscurity of the tail light on the car ahead. This, in turn, is very often due to the light being covered by dust and mud, which on a rainy day will accumulate rather quickly on a freshly cleaned tail light. The suggested remedy is to place the tail light a good deal higher up—say, below the rear window in the car. In-

cidentally, placing the license plate there would facilitate its being read more easily, as it also would be removed from the mud thrown up by the rear wheels.

Collisions at night are frequently caused by bright headlights blinding the drivers of cars. I believe matters would be improved if headlights were mounted in the body near the two upper corners of the windshield. I say in the body and not on the body. Perhaps one centrally located overhead headlight in combination with two front fender lights would give all the

illumination required. Furthermore, one headlight would compel the driver, more or less, to keep the bulb in good condition, viz.: have both filaments working. Then we would no longer meet the fellow with only one light burning and that usually the outer one.

The reason for advocating the overhead light is that it would allow the beam of light to be directed downward instead of almost blinding the driver in the oncoming car.

ROBERT HOFSTETTER.

Murray Composite Bodies on Lincoln Assembled Without Counterboring Wood

THE Lincoln bodies by Murray are of the composite type, in which wood is utilized for practically all the framing of the body and doors, with stamped steel paneling and an all-steel cowl. Elaborate precautions have been taken to insure a strong yet sufficiently flexible structure with least possibility of developing squeaks.

The entire exterior was designed as a unit, with smooth flowing lines extending from the radiator to the rear of the body. The interior is designed to create a quiet, dignified and restful atmosphere. The upholstery fabrics used are high quality broadcloths and French Bedfords, trimmed with bindings and laces to harmonize. In most cases the color of the upholstery materials blends with the exterior coloring of the car.

The entire front seat is adjustable, with a total fore and aft movement of $3\frac{1}{2}$ inches. The doors are wide, ranging from $30\frac{3}{4}$ to $40\frac{1}{8}$ in., according to body type. The front seat of the five-passenger coupe is so constructed that it moves forward when the back is folded, providing unusual access to the rear compartment. The seven-passenger models have full-sized auxiliary seats.

Cushion springs are of the Comfort and Marshall type having each coil enclosed in a separate cloth sack. Over the springs is placed a thick curled hair pad to which is added loose curled hair to give the desired surface shape, followed by a layer of furriers' wadding to prevent the hair from working through the upholstery cloth.

Trim panels are composed of waterproof fibreboard and sufficient padding to give them the desired shape. They are then covered with the upholstery cloth which is cemented and stitched in place.

The bottom of the seat pans is sprayed with a silenc-

ing compound and a thick hair pad is installed under the carpets, which silence road noises to a large extent. An inner dash panel composed of a special composition and hair pads totaling $1\frac{1}{8}$ in. thick prevents the transmission of motor noises into the passenger compartment and also serves as a heat insulator.

The front doors are equipped with double dovetails, preventing vertical movement and noise. The glass channels are of metal, lined with felt, eliminating the possibility of glass rattles. The door windows are supported by means of double arm cadmium-plated regulators. Cadmium is somewhat self-lubricating in nature and insures freedom of operation and silence in these units.

The low appearance of the car is partly due to mounting the body on out-riggers rather than on top of the chassis frame, allowing the heavy body sills to overhang the chassis frame.

The final assembly of the body frame with the front end unit is done in a huge master framing jig equip-

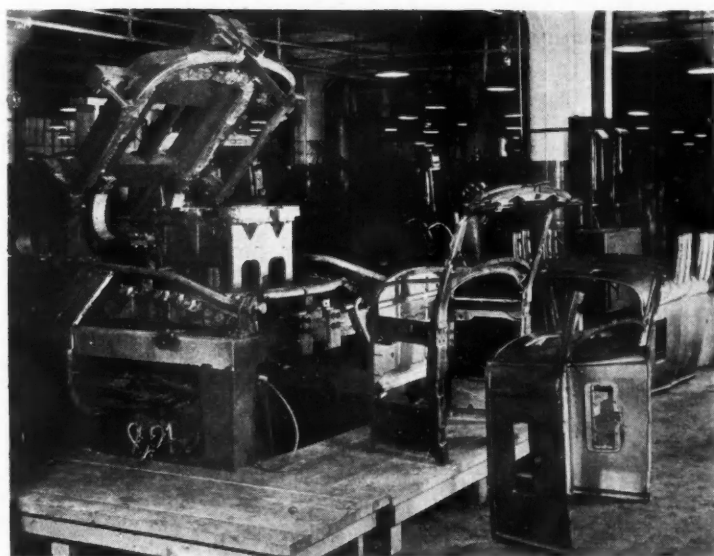


Fig. 2—Interior framing with close-up of constructional details

Fig. 1—Details of cowl assembly on bar-welding machine

Fig. 3—Clinching door cover panels

ped with stops and clamps which absolutely prevent dimensional vibration of the complete structure. Before shipment the complete body is checked again on a special inspection fixture, which insures that the body will fit perfectly the chassis and the various sheet metal parts, such as hood, fenders, splash aprons, etc.

In the body and door frames, heavy wood sections are employed. Wherever size permits these are made up of several laminations, with individual pieces tongued and grooved and ends finger-tenoned into one another. By cross grain plying, and laying the grain as nearly parallel to curves as possible, more than usual strength is obtained. No seamed and bent members are used, this applying to top bows as well, as each wood part is built up and cut to the desired shape. It is believed that this method of construction removes any possibility of warping or other alteration in shape or size under the most severe weather conditions.

The main sills extending from the front to the rear of the body, are built up of laminated oak and beech. They are unusually heavy, having a "z" section approximately 5 by 6 in. at the heaviest part, which is almost at the center of the body. The central cross sills are of wood enclosed in steel channels.

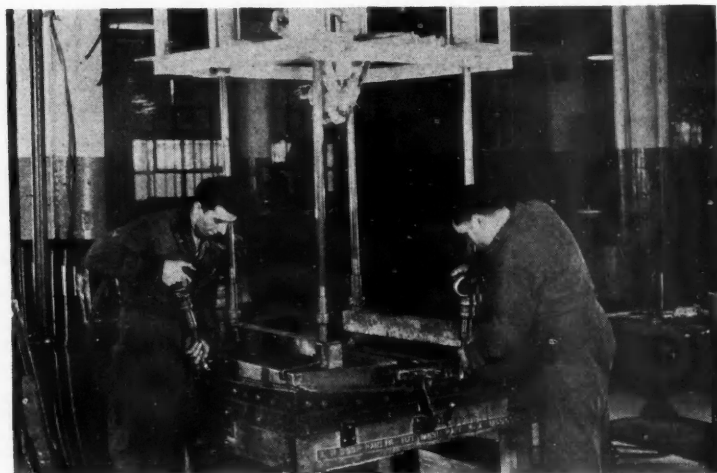
Floor boards are all 5-ply fir, $\frac{3}{4}$ in. thick, practically eliminating the warping and splitting tendencies of one-piece stock when used for this purpose.

The front end unit is built entirely of steel. The pillars are of two sections, welded together in such a manner as to provide a box section which minimizes the corner blind spot to a large extent without sacrificing strength. The cowl bar, header bar and dash-to-pillar braces are heavy stampings. The entire unit is assembled by riveting and welding. See Fig. 1.

The cowl paneling consists of three units. The cowl side panels with the pillar cover integral, are stamped as single units and welded to the cowl center panel forming an essentially one-piece unit. Finally the paneling is spotwelded to the framework at about $1\frac{1}{2}$ in. intervals the full height of the pillars, across the cowl bar, and entirely around the dash, thereby tying this assembly into a rigid, essentially one-piece unit.



February 20, 1932



The roof is of the double rail woven wire type. The sub-roof rails are attached to the main roof rails by means of four heavy gage stampings on each side which are bolted in place. Some of this detail may be seen in Fig. 2. Roof bows are placed relatively close together and covered with cork tape to prevent chafing. The woven wire, which is galvanized after weaving, is stapled in place under tension.

Rear doors are of full composite construction, the frame having wide wood bottom boards and lock boards. The edges of the frame are encased in steel panels, welded at the intersections, over which is applied a one-piece outer panel clinched over the pillar cover panels, as in Fig. 3, and then spotwelded at intervals to prevent relative movement. Padded blocks brace against the center of the outer panel to prevent rumble.

The front door hinge pillar is of steel, forming a box section. The steel door header panel is then welded to it at the upper front corner. The hinge pillar face panel is in turn welded to it at the upper rear corner.

The front doors are supported by four heavy hinges. This type of hinging supplemented by the double dovetails, entirely eliminates any possibility of the doors sagging.

Door window regulators are of the double-arm type. Arms, plates and other parts are cadmium-plated and lubricated before assembly so that they will be free from rusting in service and require little if any attention. Exposed parts of locks and latch plates are chromium-plated.

Body framing joints which are subject to movement are bedded in an anti-friction compound which provides permanent lubrication. Joint strength is maintained by the use of steel reinforcements. Frictional contact at the junction of the various metal parts to the wood parts is prevented by the use of anti-friction paste and anti-squeak fabric.

A large number of bolts is used in the frame construction instead of screws, due to the use of a new type screw boss nut which eliminates the necessity of counter-boring the wood parts and thereby weakening them.

Fig. 4—Gas-welding roof joints at final assembly line

Automotive Industries



Production Lines of the Industry. No. 9

The engine-assembly line at General Motors' Vauxhall-Chevrolet plant at Luton, Bedfordshire, England

Handbook Stuff

"Alcoa Aluminum and its Alloys" is a valuable little handbook just published by the Aluminum Co. of America. Its chief virtue lies in a section containing 30 tables giving information concerning physical and chemical properties of aluminum alloys. You will also find tables giving the standard sizes of the basic commodities together with their commercial tolerances. Mighty handy for the five-foot shelf.

One Step Ahead

Saw a remarkable film at the production session of the S.A.E. annual meeting. The latest wrinkles in automatic loading for automatic lathes was shown for the first time by Ed Smith of the Seneca Falls Machine Co. He demonstrated the startling possibilities of hooking up a battery of machines with a fool-proof automatic attachment more-than-human in action. More than one in the audience felt that history was being made before his eyes.

William Green Speaking

The past ten years has brought unusual rapidity in technical progress. This is apparent from comparing the increase in productivity between 1919 and 1929 with that from 1899 to 1919: 54 as against 26 per cent. To state this in another way: This increase in productivity shows up sharply when translated into hours. Work that kept a workman busy 59 hours a week in 1899 was done in 47 hours in 1919; work which was done in a

52-hour week in 1919 was done in 34 hours in 1929. . . . We must work out principles of balance; increasing output against capacity to buy; increasing productivity against increasing leisure; technical progress against the available supply of labor; output against the incomes of buyers; volume of business against available credit, etc. We can attain sustained business prosperity only if we understand and apply principles of balance. We can advance the welfare of mankind safely in this complicated age only when we understand the principles of balance between forces which work for progress and retrogression. — *From Research Narratives, Vol. 12, No. 3.*

What's Shot Welding?

We've been asked to explain shot welding. Not much detail is available because it is a brand new Budd development just entering the production stage. Suffice it to say that shot welding is a new form of resistance welding performed at a tremendously higher speed. By acting in a brief time interval, the applied heat has no time to spread and does not burn the metal. This is vital in working stainless steel because the application of heat reduces its non-corrosive properties.

Free-Cutting Brass

Some interesting information concerning the machinability of free-cutting brass was given by Alan Morris at the N. Y. meeting of the A.I.M.M.E. this month. By means of a rapid and inexpensive test he

has established the following conclusions:

1. Tensile properties cannot be used to indicate machining quality of brass rod.
2. Machinability of annealed leaded brass is harmfully affected by the presence of beta.
3. Machinability of muntz metal (about 60 per cent copper, 40 per cent zinc) improves rapidly with small additions of lead but much less rapidly as lead content increases. Within the range of 60 to 63.5 per cent the effect of copper is small.

Profitable Research

Quoting Maurice Holland of the National Research Council, here are several large-scale research programs designed to be a big help to the automotive industry.

Name	Annual Budget
American Gas Association	\$200,000
American Paint & Varnish Mfrs. Assn.	50,000
American Petroleum Institute	100,000

Intrinsic Values

Gordon Lefebvre speaking at the production session of the S.A.E. annual meeting said that one of the foremen in your plant probably represents an investment of about \$5,000. If this sounds high let me say that a speaker at the last A.S.M.E. annual meeting measured the investment his company has made and set the value at \$10,000 to \$15,000. It's a serious thing. Let no one assume that the minor executives in the production division can be shunted around or out with impunity. They cost the stockholders real money.—J.G.



Accuracy in High Production Shown

by Joseph Geschelin

WITH the changing complexion of automotive production, unit-type machine tools probably will find even wider usefulness. They answer the requirements of a special purpose, high output tool, and they provide the flexibility essential to the faster tempo of model changes.

Since the general economic considerations of unit machines were discussed recently,* it is proposed in this article to study some of the intimate details of a specific type of machine—drilling and tapping tools built by the Kingsbury Machine Tool Corp., Keene, N. H.

With the general advent of the automatic drilling head about eight years ago, closely followed by its companion, the automatic tapping head, the way-type drilling and tapping machine was developed to a remarkable degree by many machine tool builders. The most familiar machines of this class probably are the huge, two-way, three-way, and four-way drillers and tappers operating on cylinder blocks, crankcases, and the like.

For convenience the word "drilling" as used here includes the analogous operations of reaming, counterboring, spot-facing, hollow milling and in fact almost any operation performed by a rotating spindle carrying a cutting tool. Threading is performed by the automatic drilling head with a rotating self-opening die head; light milling operations by an attachment secured to the quill and mounted on guide posts or a slide for rigidity.

*"Unit-type machines fit the program of frequent production changes in automotive plants" by Joseph Geschelin, *Automotive Industries*, Aug. 8, 1931.

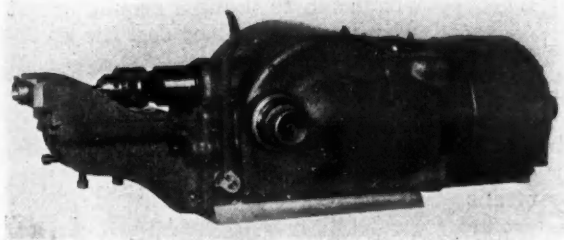


Fig. 1—The automatic head is the heart of any unit type machine. This head is a self-contained mechanism with independent drive and feed

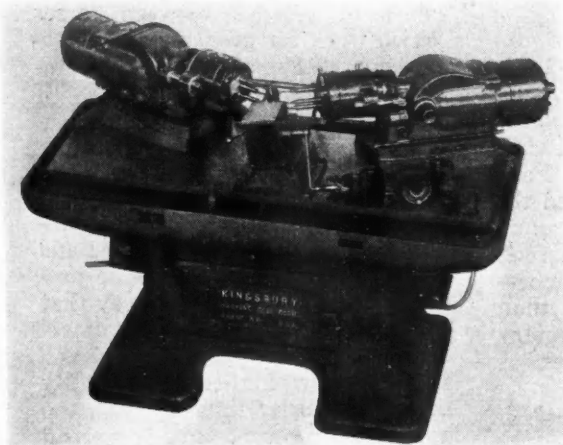


Fig. 2—Simple way-type machine with two automatic heads

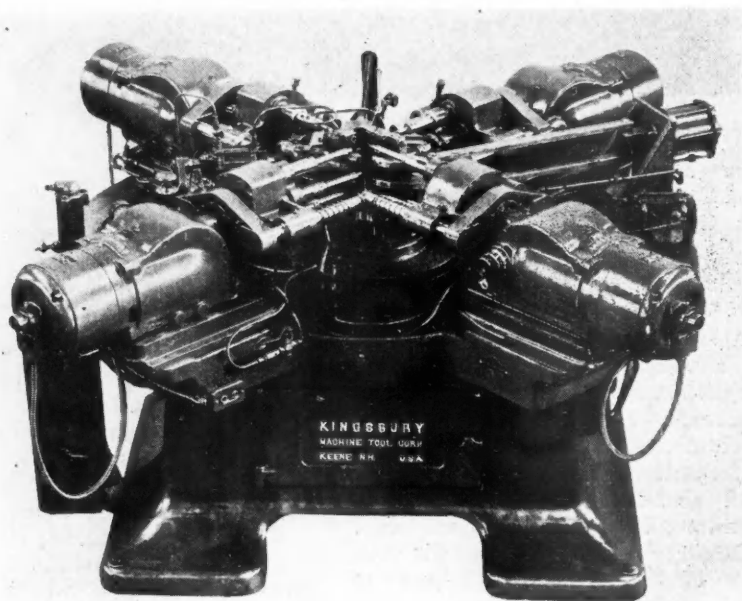


Fig. 3—Kingsbury recently built this more complex way-type machine used to spot-face five holes in the housing shown in Fig. 4

by Unit Machines of Kingsbury Type

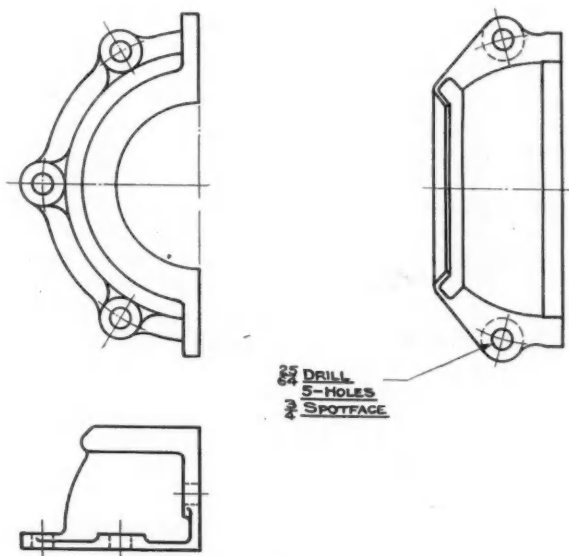


Fig. 4—Universal joint housing has five holes spot-faced on machine shown in Fig. 3

The Kingsbury head, Fig. 1, may be described briefly as a housing containing a spindle and quill, with an attached motor and a self-contained automatic feeding device. It contains a tripping device which when actuated manually, pneumatically, or electrically, engages the feed, causing the spindle to go through its cycle of quick approach, slow feed, quick return to the starting position and stop. Pick-off gears are provided for changing both speed and feed. Compactness, anti-friction bearing construction, and other design features enable this head to be mounted in any position from vertical pointing down, to vertical pointing up.

The head shown is equipped with an automatic clamp slide or guide bushing carrier. This is in the form of a dovetail slide mounted on a knee attached to the front of the head. The slide carrying the drill guide bushing travels forward with the spindle to a

definite adjustable stop or until it strikes the work. From this point the spindle continues and finally picks up the slide on the return stroke. The forward motion of the slide is obtained by a powerful compression spring.

The automatic tapping head is similar in all respects with the addition of a reversing clutch, automatically shifted when the spindle is in the extreme forward and back positions.

The unit principle does not stop with the automatic heads, but includes various types and shapes of tables, pedestals or stands, also columns, adapter plates, coolant pump units, and to a certain extent work holding fixtures. Following the modern trend of machine tool design, a good deal of thought has been given to chip disposal. Tables have large openings between the head and fixture mounting surfaces to permit chips and coolant to fall either into a chip pan in the cabinet base, or on an inclined chute which delivers the chips to disposal conveyors. In the former case the coolant is strained out of the chip pan into a sump in the base, and the chips removed manually through openings in the side. In the latter case the coolant is either strained out of the chute, or where the plant uses central coolant supply systems, is allowed to follow the chips to the disposal conveyor from which it is later reclaimed.

The way type machine has found an increasing field on the lighter automotive parts and accessories where it not only increases production usually several fold, but also attains greater accuracy in location of holes due to elimination of numerous chuckings. A good example of this is found in Fig. 2 which is a six-spindle machine for drilling anchor holes in bearing caps.

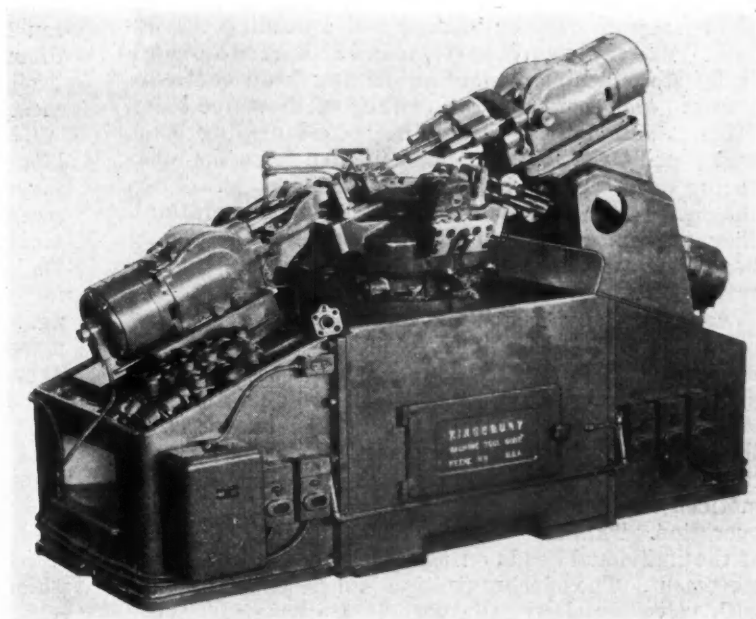


Fig. 5—Example of automatic indexing unit type drilling machine. This is designed not only to drill a number of holes but can be arranged for a sequence of operations on the same hole

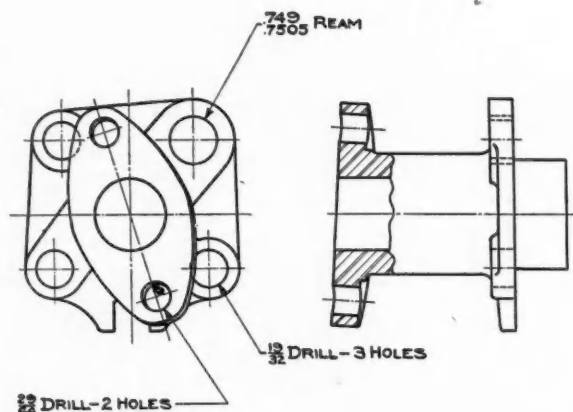


Fig. 6—Steering gear case drilled and reamed on the machine shown in Fig. 5. The indexing fixture is not automatic but could be so arranged if production warranted

Recently this company shipped a way-type machine (Fig. 3) which illustrates the complexity of the work within its range of possibility. It was designed to drill and spot-face five holes in the universal joint housing shown in Fig. 4. It will be noticed that on this type of machine the work is not indexed but instead the operations are performed from different directions in one setting.

The part is clamped by means of two air-cylinders, each operating two compensating clamping arms so as not to distort the work. This piece is rather frail and as the drilling must necessarily be done against the clamp in order to spot face in the same chucking, the clamping presented somewhat of a problem. To prevent clashing of the tools, an automatic synchronization method is used which operates pneumatically.

After the operator drops the work into the fixture and throws the clamping valve handle, he depresses the handle of the trip valve. By virtue of a safety valve in the trip line, the trip will not function unless the work has been clamped. Depressing the trip valve, trips one drilling head and the two spot facing heads which automatically stop after rapid advance through the space required for loading and unloading the fixture. The two spot-facing spindles therefore automatically stop feeding while one drilling head continues through and completes the drilling of the three holes. Then it automatically trips the second drilling head, which drills the two holes and in turn trips the spot-facing head, which spot-faces the three holes. When the last two heads have completed their operations, they automatically trip the two-spindle spot-facing head which then faces the two remaining holes and returns to its starting position.

Another class of drilling machine employing unit construction is the automatic indexing type. These machines not only drill a number of holes in different planes, but can perform a sequence of operations on the same hole. To obtain the utmost productivity, this machine is not set up to directly index in a predetermined time cycle. Rather it is designed to automatically index upon the completion of the slowest operation. This is achieved by synchronizing the feed of the individual heads on the machine with the index movement. The synchronization is done pneumatically with valves or electrically with limit switches. With

this scheme the index trip cannot operate until all the feed mechanisms are in their starting positions. Likewise, the feeds can not start until the index movement has been completed.

Fig. 5 illustrates a machine of this type. It was built recently for reaming and drilling the steering gear case cover shown in Fig. 6. This particular machine is fitted with a hand indexing fixture instead of an automatic, although it could have been built for automatic indexing as well. To permit drilling all the holes in one chucking, the part was located into the machine on an angle. It could, therefore, be drilled from both ends by reaching across the turret with one set of tools as shown. To perform two operations on the same hole as in drilling and reaming, a scheme is used of locating the drill guide bushing in a sliding bracket on the front of the drilling head which automatically approaches the work and locates into the fixture, therefore assuring accuracy of location of the drilled hole. Later in the cycle this hole is reamed.

Another variation out of an almost unlimited number of combinations of standard units is an automatic chute feed machine which is designed to drill and mill a starter shaft. Essentially it consists of a vertical drilling head and a horizontal milling head which together with a special fixture are mounted on a standard base and table. In operation, the machine is fully automatic in feeding, clamping, drilling, milling, unclamping, and ejecting. The operator merely loads the hopper chute.

Apart from the economic advantages of the unit-type machine, there are other considerations of great importance to the production executive. It has been demonstrated in specific cases that these machines are capable of high productivity so that a greatly increased output may be obtained in the same limited floor space. But perhaps the most valuable feature in many instances is that of achieving a higher degree of accuracy at an augmented production rate than was possible at the lower rate.

Stratosphere Adventures

(Continued from page 252)

becomes thinner and thinner, with constant engine power the propeller speed will increase, and to prevent racing of the engine the characteristics of the propeller must be changed. It is possible to vary the pitch, the diameter, and the number of blades, but at present designers seem to prefer variation of the pitch as the most practical method.

The Guerchais plane is provided with a Ratier three-bladed propeller of variable pitch. The blades are of forged duralumin and the hub is of forged steel and completely machined. The principal difficulty in connection with variable-pitch propellers is that the blades must be adjusted while they are rotating rapidly and are therefore subject to a very large centrifugal force, as well as to a bending moment. There is, moreover, a torsional couple on the blades, due to aerodynamic forces, which tends to turn them into the plane of rotation.

The Ratier propeller is so designed that the centrifugal force and the torsional couple neutralize each other, hence the effort required in varying the pitch of each blade is greatly reduced. Each duralumin blade is set in a ferrule of nitrided steel, the ferrule being keyed to it and secured in place by a lock-nut which abuts against a shoulder on the root of the blade. A roller bearing supports the blade at its inner end.

Stromberg Automatic Choke Opens as Engine Warms

Fig. 2—Top view of automatic choke

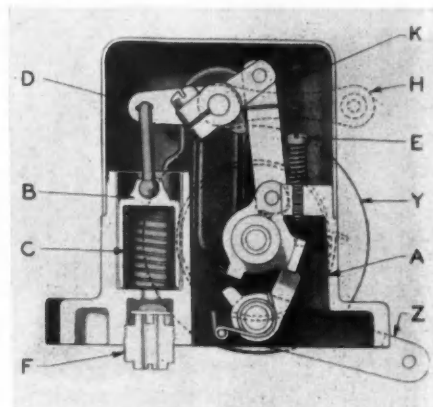
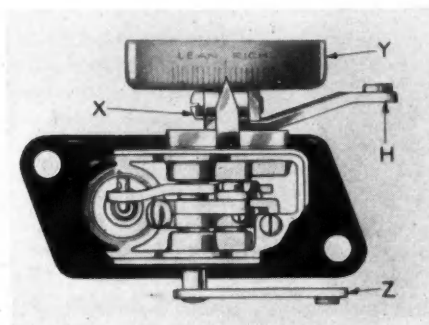


Fig. 1—Vertical section through automatic choke

A DEVICE that automatically operates the choke valve of a carburetor in accordance with the temperature of the engine has been developed and is being sold to car manufacturers by the Bendix Stromberg Carburetor Co., South Bend, Ind., subsidiary of the Bendix Aviation Corp. Oldsmobile was the first car manufacturer to adopt this automatic choke as standard equipment on its six and eight-cylinder models for 1932.

The automatic choke consists of a thermostat spring, a mechanical linkage, a vacuum piston and a safety release lever. An offset choke valve is necessary in the carburetor, hence a new model Stromberg has been developed to be used with the choke. The two devices are sold as one unit.

The thermostat spring is used to close the choke valve when the engine is cold (below 70 deg. Fahr.),

and gradually permits it to open as the engine warms up, until at 120 deg. and over it is wide open, thus tending to maintain the correct mixture at all temperatures.

The mechanical linkage locks the choke valve in the closed position after the thermostat has closed it, in order to hold the valve shut while cranking. The linkage is unlocked by action of the vacuum piston as soon as the engine fires and vacuum from the manifold allows the choke valve to open against the thermostat spring tension.

The carburetor choke valve lever is connected by a rod to a lever on the automatic choke (H, Fig. 1). This latter is operated by a shaft controlled by the thermostat spring which is mounted in a definite position to the exhaust manifold.

Operation of the automatic choke is as follows:

The thermostat A returns the carburetor choke valve to the closed position when the thermostat is at 70 deg. When colder than this, the valve is locked by linkage K and is thus held during cranking of the engine until the engine fires and a manifold

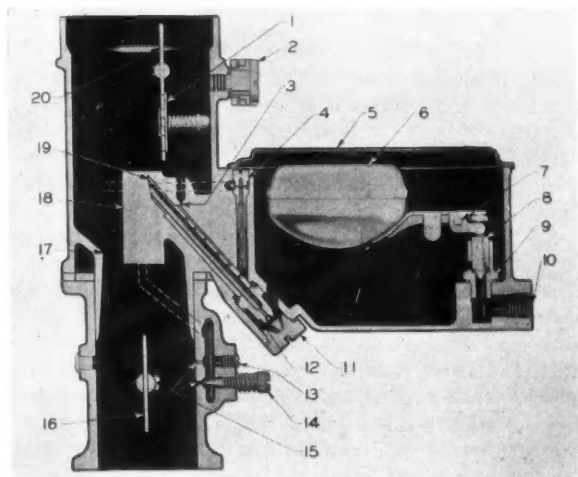
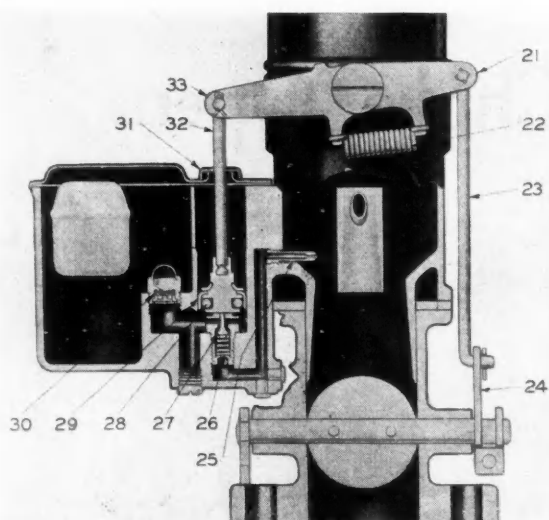


Fig. 3—Section through Stromberg Series E carburetor transverse to throttle axis

Identity of Parts in Construction of Stromberg Series E Carburetor

- | | |
|----------------------------|----------------------------|
| 1. Poppet valve | 11. Main discharge jet nut |
| 2. Fulcrum screw | 12. Main metering jet |
| 3. High speed bleed | 13. Idle discharge plug |
| 4. Idle tube | 14. Idle needle valve |
| 5. Float chamber cover | 15. Idle discharge holes |
| 6. Float | 16. Throttle valve |
| 7. Float fulcrum pin | 17. Primary venturi |
| 8. Float needle valve | 18. Auxiliary venturi |
| 9. Float needle valve seat | 19. Main discharge jet |
| 10. Gasoline inlet | 20. Choke valve |



- | | |
|--------------------------------|------------------------|
| 21. Pump lever arm | 28. Pump piston spring |
| 22. Pump arm connecting spring | 29. Pump piston |
| 23. Pump rod | 30. Check valve |
| 24. Pump lever | 31. Dust cap |
| 25. Pump discharge nozzle | 32. Pump piston link |
| 26. Economizer by-pass jet | 33. Pump piston arm |
| 27. Economizer valve | |

Fig. 4—Section through Stromberg Series E carburetor on throttle axis

vacuum is created. This vacuum pulls down piston B and through lever D unlocks the linkage K, allowing the choke valve to open against the tension of the thermostat spring A. Tension of this spring controls the choke valve opening and closing and is adjustable by loosening screw X (Fig. 2) and turning the case Y. Putting the arrow on the "rich" side tightens the thermostat, while the "lean" side lessens the tension. For example: If the choke is not completely closed at 70 deg., by revolving case Y so the arrow is on the "rich" side, the choke valve will close completely, or by putting the arrow on the "lean" side the choke opens farther.

Linkage K is adjusted at the factory and the setting should not be changed except in rare cases. It is adjustable, however, by screw E and must be set only when the thermostat is cold. When the setting is correct the lever H has a very pronounced catch when pushed down, yet will open under a tap with a lead pencil. Turning screw E to the

right unlocks the linkage, while turning it to the left increases the tension. Safety lever Z is connected to the carburetor throttle and unlocks the linkage K when carburetor throttle is wide open.

Because installations differ so widely on various makes of cars, the Bendix Stromberg Co. has developed the E series carburetor to be used with the automatic choke. Figs. 3 and 4 show the various parts of the E series, a downdraft type of the plain-tube variety with a primary and a secondary venturi. It is made in both single and double-barrel construction.

Among the outstanding features of the new carburetor is a positive accelerating device consisting of a pump which delivers an accelerating charge immediately the throttle is opened, and meters and delivers this charge over a definite period of time.

Also an economizer has been built into the E series which insures a lean and economical mixture at normal driving speeds, yet automatically supplies the richer mixtures needed for maximum power and high speed. Idle or low-speed jets are below the throttle, and a relief poppet valve has been placed in the choke valve to prevent over-choking.

On the new Oldsmobile, the six-cylinder model uses the EC-2, while the eight uses the EE-2, the latter being of double-barrel construction.

A. P. I. Hits Motor Restriction as Railroad Aid

by L. W. Moffett

THERE is no justification for imposing an unnecessary burden of regulation or restriction upon motor transportation merely in the interest of the railroads, declares the American Petroleum Institute, in exceptions it has filed with the Interstate Commerce Commission which sharply attack the report of Examiner Leo J. Flynn proposing regulation of motor vehicle regulation. The report covers the investigation into the so-called motor-rail coordination study. The exceptions of the Institute follow others that have come from motor and related interests. Arguments in the case have been set for March 1, 2 and 3.

The Institute says the controlling influence leading to the proposal of regulation of motor vehicle transportation is merely a conception of what is necessary to protect the railroads from the competition of motor vehicle transportation, entirely without regard to

whether or not railroad management has itself sufficiently readjusted railroad service and charges in order to meet the competition in a business-like way. The proposed report, it is pointed out, would absolve the railroads from any necessity for meeting the competition of the motor vehicle either in matter of service or matter of charges.

A joint brief filed by six highway interests also urged that additional regulation for motor regulation is not necessary, but rather there should be less regulation for the rail carriers. These interests were the Philadelphia Team and Motor Truck Owners' Association, the Pennsylvania Motor Truck Association, the Pennsylvania Furniture Warehousemen's Association, the Maryland Motor Truck Association, the Interstate Motor Carriers' Association and the National Team and Motor Truck Owners' Association.

Rear Engine-Mounting and Streamline Adapted to Small Cars

(Continued from page 256)

stream between the road and the platform.

Spindles for both front and rear wheels are carried in vertical guides upon which they slide as the wheels are deflected by road shocks. Rear guides are fastened to the platform, while front wheel spindles slide in guides within vertical tubes and the tubes are arranged to turn about vertical axes. These tubes are supported by pressed steel members which in turn are bolted to the platform. Body pillars are also secured to the platform.

Aft of the passenger compartment, the upper floor of the platform is omitted and the entire powerplant, including the worm-gear final drive, is mounted on the longitudinal girders. A water expansion tank is placed well above the engine, and below it, forward of the engine, is an 11-gal. gas tank.

To avoid all possible interference with outside air flow, the muffler is placed in the engine compartment. It is housed within a sheet metal sleeve ending in a venturi opening around the tail pipe, so arranged that the exhaust pulls air around the muffler from the engine compartment and discharges it, along with the exhaust, at a flush rear opening. The engine is a Continental Model H-8 (153 cu. in.). It is said to have driven the car at speeds in excess of 85 m.p.h. without the throttle being wide open. The gearset is a standard Detroit Gear & Machine Co. model. Control connections for the gear shift and the engine throttle are carried through the duct between platform floors.

Brakes act only on the rear wheels. The foot-operated pair are contracting bands on the rear wheel drums. Each brake is anchored to a tube pivoted at its forward end to the platform, and operation is by cable. A pair of hand-operated brakes act on drums on opposite sides of the differential. Drive from differential to rear wheels is by shafts having a universal joint at each end. Reduction at the worm gear is $3\frac{1}{4}$ to 1.

Steering is through a spur pinion on the lower end of the steering shaft, which meshes with a straight rack connected to the tie rod. This is made possible by the fact that there is no relative vertical motion between tie rod and body.

As photographs indicate, the body is streamlined about as well as is possible with a four-wheel car having an 85 in. wheelbase and a 13 ft. overall length. There are no projecting hinges, fenders or other obstructions to cause eddies. A rounded buffer strip some 8 in. wide runs entirely around the body, except at the front wheel housings. Headlamps are recessed into the nose of the car.

At the front the superstructure is almost as wide as the lower portion of the body, but in plan it tapers rapidly toward the rear. The roof is also nicely curved and slopes downward as it is narrowed toward the rear, thus giving what seems to be an excellent streamline form. As viewed in plan, the front corners of the superstructure are well rounded, and this necessitates the use of curved glass panels at each side of the windshield. There is a narrow pillar at each side of the windshield, and a still narrower molding joins the

curved glass to flat movable panel between it and the front pillar, which, on the right side of the car, forms the hinge pillar of the single entrance door. All glass is shatter-proof and is as nearly flush with the outside of the pillars as possible so as to avoid breaks and eddies along the surface.

There is said to be 48-in. headroom inside the body, although the overall height is only a little more than 5 ft. Total weight with tanks filled is given as 2150 lb. The battery for the starting and lighting system is placed beside the radiator.

A desire for still better streamlining led to the development of the three-wheel vehicle. It is extremely unconventional in appearance, but it is said to be capable of speeds well in excess of 60 m.p.h. when driven by a $7\frac{1}{2}$ hp. (45 cu. in.) Austin engine. In this case the engine is placed transversely back of the seat and drives by chain to the single rear wheel. The latter is positioned in a well-braced frame which is pivoted on the horizontal axis of the engine, so that vertical motion of the wheel when it passes over an obstruction does not alter the chain length. Rubber cord suspension is employed for the wheel frame.

The platform for the three-wheeler is similar to that for the first car described, except that it is triangular in shape and is not made to convey air. Only a small part of the space available in the rear is required for the powerplant, consequently the radiator can also be placed in the compartment. Access to the driver's compartment is through a single door in the front of the car. The upper panel of the door forms the windshield. At each side of this door is a curved glass panel affording excellent forward vision. Side windows permit of good vision to right and left and some toward the rear.

Front wheel and steering arrangements are practically identical with those in the four-wheeler, and brakes act on a rear wheel drum. In the compartment with the engine is a 6-gal. fuel tank. The weight of the complete car is given as 800 lb. While the engine is not well placed from the standpoint of accessibility, it is so small as to be easily removed if much attention is required. Changing of rear tires is comparable to the same operation on a motorcycle.

No plans for the production and marketing of either car have been completed as yet.

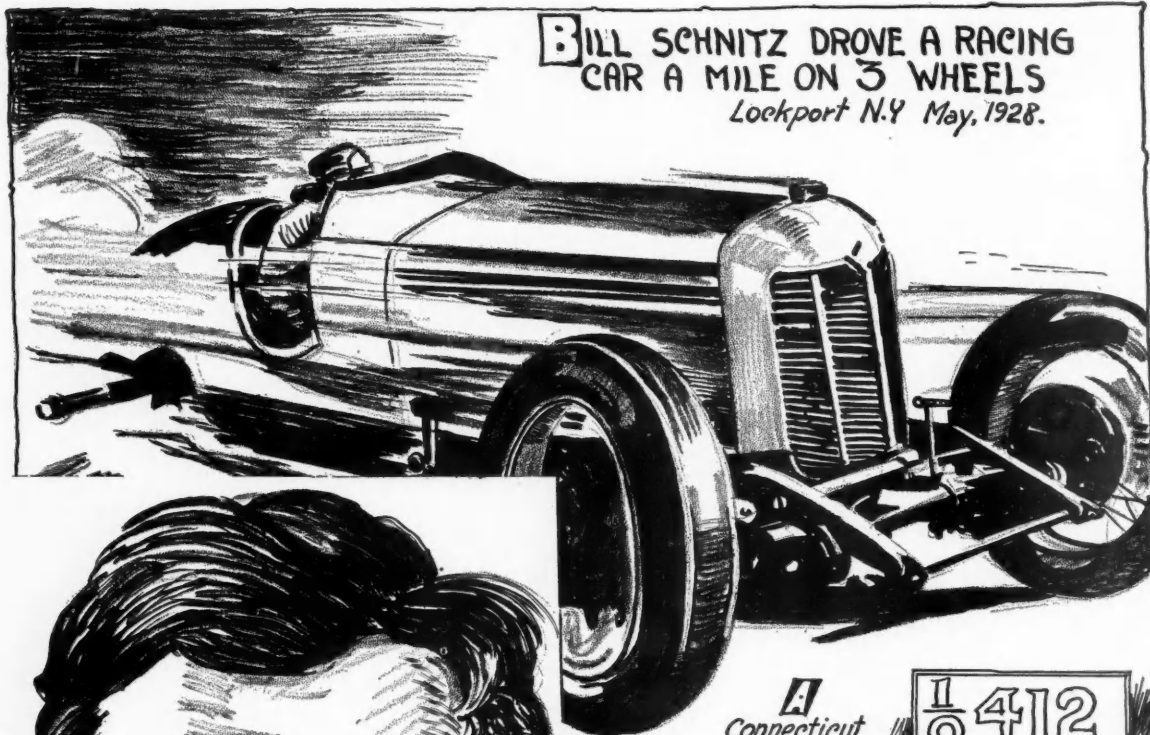
Kellett Open-Cockpit Autogiro

(Continued from page 253)

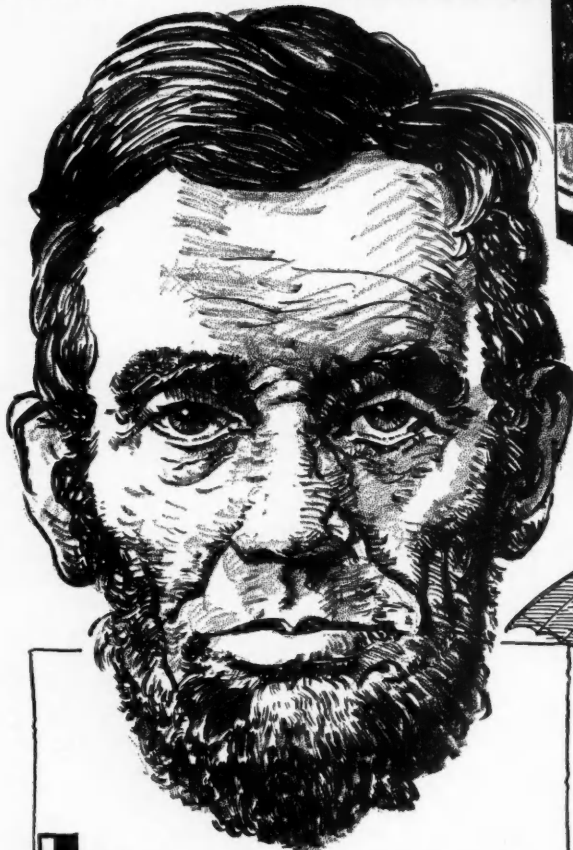
by providing a line of rivets on each side of the corrugation. All joints between the metal and pyralin are riveted. All joints between the top and the fuselage are padded to waterproof them.

It has been found that the better streamlining of the ship with the top in position increases its speed by two or three miles per hour. The weight of the complete top is 23 lb., but since it replaces the standard windshield and door of the open model, it involves an increase in total weight of only 19 lb.

Automotive Oddities—By Pete Keenan



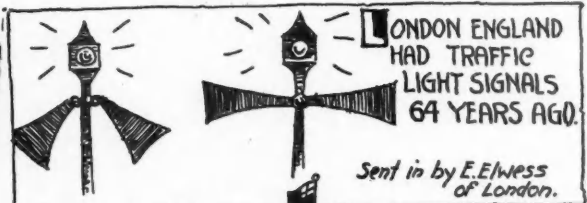
BILL SCHNITZ DROVE A RACING CAR A MILE ON 3 WHEELS
Lockport N.Y. May, 1928.



LINCOLN DROVE AROUND IN A STUDEBAKER— BUT IT WAS A CARRIAGE. The carriage he used will be exhibited at the 1933 Chicago Fair.

A
Connecticut
license plate
Thanks to Rosamund
Cruikshank

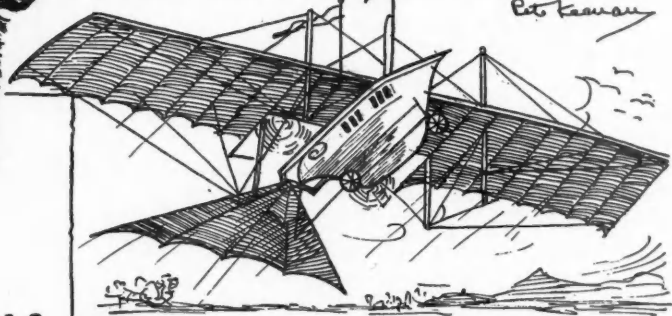
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LONDON ENGLAND
HAD TRAFFIC
LIGHT SIGNALS
64 YEARS AGO.

Sent in by E. Elwess
of London.

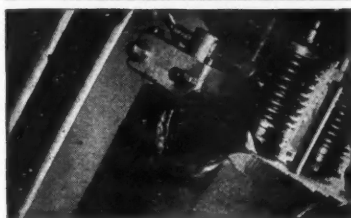
Pete Keenan



ON 1842, W.S. HENSON AN ENGLISHMAN PATENTED A STEAM DRIVEN AIRPLANE. There was a bill proposed in Parliament to incorporate the "Aerial Steam Transit Co."

Do You Know
An "Oddity"?

Correspondence about "Automotive Oddities" is invited. Contributions used will receive editorial mention when practicable. If you are interested in the source of, or the reason for, a particular "Oddity," ask the editorial department of Automotive Industries about it.



NEWS

OF THE INDUSTRY



Chrysler Earns 33c, Gain of 28c

Net Income \$1,468,935,
Against \$234,155 in 1930

NEW YORK, Feb. 17—The Chrysler Corp. reported yesterday that its earnings and number of automobiles which it sold last year were both greater than in 1930. Walter P. Chrysler, chairman, announced that the net income last year, after providing for all interest, taxes and depreciation charges, was \$1,468,935, equivalent to 33 cents a share on 4,404,365 shares of common stock, compared with a net income of \$234,155, or 5 cents a share, in 1930.

Sales last year totaled 272,118 units, valued at \$183,805,104, compared with sales of 269,899 units, or \$207,789,338, in 1930.

Mr. Chrysler said the company improved its 1931 performance despite business conditions, which were even more adverse than in 1930. He ascribed the company's better earnings to more economical and efficient operations and to its more aggressive policy in the low-priced car field, through the introduction of its new Plymouth car last year.

"What may be expected in the current year can be little more than conjecture.

"There are constructive forces within the industry itself on which improvements in sales may reasonably be expected," Mr. Chrysler said. "To what extent such improvement will become actual depends to no small degree on general business conditions. Here, too, however, may be found hopeful grounds for the belief that the corrective and recuperative remedies now being applied to the economic situation here and abroad may be productive of tangible results, especially in restoring the greater measure of public confidence which is an essential to business betterment.

(Turn to page 274, please)

AMONG the government's exhibits before the august court was some corn cake "dunked" in radiator fluid. The general idea of his honor's decision was that CH_3OH , $\text{C}_2\text{H}_5\text{OH}$, et al., are contraband to both chief and squaw, as have been all $\text{C}_2\text{H}_5\text{OH}$ beverages for these many years.

Last week Studebaker celebrated 80 years' activity by running the first Rockne "65" off the lines.

Pioneering caravans into the wastes of Alaska, the veldts of Africa, the lowlands of Turkestan carried the conquest of commerce on Studebaker wagons; the colossal wealth of the Klondike, Skagway and the Transvaal has been carried down to the seas for generations with wagons and trucks built by the House of Studebaker.

One of the episodes of this industrial romance is shown on the preceding page—to commemorate the birth of the Great Emancipator and another emancipator of toil.

Ambassador John North Willys' departure yesterday to resume his duties at Warsaw puts to rest rumors about his taking over the W-O management. Sir William Letts accompanies him.

It seems that Canadian Indians were buying used cars for the privilege of getting anti-freeze to pep up the good old powwows when tribes gathered.

THE NEWS TRAILER

Congress Shuns Excise As More Deficit Looms

Tendency to Refrain
From Taxing Vehicles
Seen in Washington

by L. W. Moffett

WASHINGTON, Feb. 18—The unwelcome surprise given members of the House Committee on Ways and Means by Secretary of the Treasury Mills in his announcement of an additional Treasury deficit estimate of \$455,000,000 for the ensuing fiscal year has decidedly changed the complexion of the pros-

(Turn to page 270, please)

Ford Production Begun on Eights

Rouge Plant Revived
As New Parts Arrive

DETROIT, Feb. 18—While production releases are reported to have been issued on 11,000 cars, parts for the new Ford cars are coming through only in limited numbers at River Rouge.

Employment, apparently, is still below the 50,000 mark at the plant, and shop rearrangement for the production of the new models is not nearly completed, which would indicate that even if Ford announces his new cars shortly, he will be unable to make deliveries in large numbers for some time to come.

Apparently, the final assembly line is not functioning yet. Bodies, while considerably improved, are still characteristically "Ford." They are lower and longer than formerly, the lowering having been made possible by the adoption of double-drop frames. The wheelbase of both the four- and the eight-cylinder model is apparently about 107 in.

The new eight-cylinder engine has the cylinders cast integral with the heavily ribbed upper section of the crankcase. Crankshafts are of the three-bearing type, with integral counterweights. The long crank arms are especially heavy, being over 1 in. thick. Aluminum-alloy pistons are used in both models. In the eight, the connecting rods have their bearings on the crankpins side by side. Piston-pin bearings are of the thin-walled, rolled type.

While it is reported that Ford intends to produce both the crankshafts and camshafts by casting, these parts are still coming through as forgings. The present four-cylinder engine has a three-point rubber mounting which gives it a certain amount of angular freedom.

Transmissions have constant-mesh helical gears for the coun-

(Turn to page 270, please)

Sees Tendency to Avoid Motor Tax. As Additional Federal Deficit Looms

(Continued from page 269)

pective taxation program.

There is comfort, however, in the tendency to give up the idea of selected excise sales taxation which would mark discrimination against the automotive industry. It has objected particularly to discrimination. It is realized enormous taxes have to be raised and each industry must bear its share, but the point is made it should be penalized simply because the method of collection would be simple, a reason which has been given for the proposed excise taxes.

With this heavy load piled on, the committee is intensifying its search for what it considers the best sources of revenue. If it decides to attempt balancing the budget, as Secretary Mills insists "admits of no compromise," it will be called upon to raise the tremendous total of some \$1,241,000,000 in the fiscal year 1933.

This total manifestly is vast, even in normal times—but in view of the present depression it is much more formidable. Cutting of budget estimates so far is proving to be only a minor help relatively estimated at \$118,000,000.

While the idea of a general manufacturers' sales tax appeared to be

gaining ascendancy as one of the best means of raising revenue, Secretary of the Treasury Mills has created surprise by approving the proposal of Representative Rainey, Democrat, of Illinois, ranking member of the committee, for taxes on gasoline, electrical energy, fuel gas, etc.

The changed position of the head of the Treasury Department was held to indicate that it was found original estimates of revenue from proposed taxes would not be realized. It is recalled in this connection that the original estimates for revenue from motor sales taxes was scaled down.

The renewed proposal for a tax on gasoline has set up many protests. The point is reiterated that this tax has been preempted by the states, whose gas taxes range from 2 cents to 7 cents. In 1930 motorists paid the huge sum of \$500,000,000 in gasoline taxes. This, it has been explained, represents an increase of approximately 36,000 per cent in a decade. The proposed Federal tax is generally placed at 1 cent, to be superimposed on existing taxes. The Federal tax is estimated to raise \$165,000,000, thus adding to what is held to be an already exorbitant tax and one that would slow down automotive production and business generally.

Ford Production Begins

(Continued from page 269)

tershaft drive and the second speed. The transmission driving pinion is forged integral with the clutch shaft, and the countershaft second-speed pinion is integral with the countershaft pinions for low-forward speed and reverse.

It seems that an automatic clutch-operating mechanism will be used but that the particular type is still in doubt. It is further reported that a mechanical free-wheeling unit will be used together with the clutch control, and if this report is correct, it is, of course, probable that gear-shift synchronizers will not be included in the equipment.

Further information on the general design of the new cars is to the effect that the fuel tank will be located at the rear of the chassis and that fuel feed will be by pump; that a cross spring will be used at the rear end and will be mounted on outriggers extending back from the rear axle housing, the object of this arrangement being to make it possible to lower the over-all height; and that 5.25 in. tires will be mounted on 18-in. wheels. Propeller shafts are said to be larger in diameter and of tubular construction. The eight, apparently, will have a single carburetor, with downdraft manifold having two branches for each cylinder block.

Stewart-Warner Reports Loss

NEW YORK, Feb. 16—Stewart-Warner Corp. reports net loss for 1931 of \$1,830,171. This compares with profit for the preceding year of \$1,262,278 or \$0.98 a share.

Budd Wheel Elects

NEW YORK, Feb. 16—Budd Wheel Company at its annual stockholders meeting in Philadelphia today re-elected as directors for three-year terms—W. R. Basset, R. D. Campbell, J. H. Michelin, William B. Read and Frank E. Smith. They also adopted a resolution approving the action of the directors during the past year.

Hudson Reports Loss

DETROIT, Feb. 16—Hudson Motor Car Co. has reported for year ended Dec. 31, 1931, a net operating loss, including depreciation, of \$1,991,199. Cash dividends totaling \$1,596,660 were paid out during the year.

The statement reports a surplus of \$20,145,503, after deduction of \$6,532,707 as the result of a decision on the part of the management to revalue the company's fluctuating assets, with no funded debt or preferred charges to be provided for.

William J. McAneeny, president and general manager, in a statement accompanying, said in part:

"This statement reflects the effect of a general decline in automobile sales during the last six months period, which has been especially difficult for concerns doing a large export business; also the decision of your management to revalue the company's fluctuating assets, domestic and foreign, to current valuation.

"Thus the company ends the year in sound financial condition, and showing a conservative book value of \$25 per share."

Continental Buys DeVaux-Hall Name

DeVaux-Hall Company
Tangibles in California
and Michigan Not Involved

DETROIT, Feb. 16—Sale of the Michigan assets, the rights to the name of the car and other intangibles of the DeVaux-Hall Motors Corp. to the Continental Motors Corp. of Detroit was authorized in Grand Rapids last week and became effective Wednesday night with the expiration of the grace period of five days required to offer creditors an opportunity to secure legal restraint.

The purchase does not involve the DeVaux-Hall Co. either in Michigan or in California, nor does it involve assumption of any liabilities of the DeVaux-Hall Co. by Continental Motors. The Oakland plant of the company is not involved in the deal and remains in the possession of the DeVaux Co., whose receivership is continued irrespective of the Continental deal.

The DeVaux dealer organization has already been advised of the move by telegraph. W. R. Angell, president of Continental Motors, expects to have the new DeVaux models (exhibited recently in New York and Chicago) in production some time during March.

The acquisition of a car manufacturer will give the Continental Motors Corp. an opportunity of expanding its manufacturing activities into other automobile units. Continental for a number of years has been carrying on experimental and development work on various chassis units, and it would not be surprising if some of these now reach production and will be embodied in the DeVaux cars.

In its last financial statement, Continental Motors showed an asset to liabilities ratio of 11½ to one. Total assets as of Jan. 1 were \$24,384,204.23, of which 2¼ million were represented by cash and securities valued at market prices at that time.

Liabilities at that time were less than \$500,000. It is the plan of Continental Motors not only to retain the present DeVaux dealer organization, but to expand it.

World's Record Beaten in England As M. G. Midget Averages 118 $\frac{1}{3}$ m.p.h.

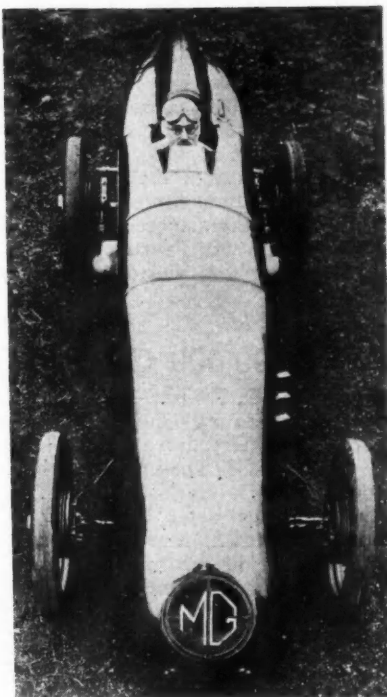
LONDON, Feb. 12—George E. T. Eyston, driving a new supercharged M. G. Midget at Pendine Sands, beat the world's speed record for "baby" cars today by attaining a mean speed of 118.38 m.p.h. over a mile course covered in opposite directions with a flying start. The previous best was 104.56 m.p.h. attained by Lord Ridley on a Ridley Special at Brooklands Speedway last autumn.

On Dec. 21 last, Eyston, on an earlier M.G. Midget, covered five miles on Montlhery Track, Paris, at 114.74 m.p.h.; but this was a single run in one direction. Both M.G. cars, and the Lord Ridley Special, come within the International Class H, with a piston displacement of not over 750 cc. ($\frac{3}{4}$ liter).

Pendine Sands were not in their best state when the runs were made; there was a good deal of casual water, and visibility was poor. At one time, in fact, fog threatened to put an end to the proceedings.

Eyston made actually four runs, but one of these was not timed, except by hand, owing to the timing apparatus failing to record on account of lack of ink! The fastest run was a shade under 120 m.p.h.

Eyston has only recently recovered from the accident he met with some weeks ago at Montlhery, when, while traveling at over 100 m.p.h. his car caught fire and he had to jump out



of it before he could slacken speed to below 60 m.p.h. As it was, he was severely burned. Today as a precautionary measure he drove in asbestos overalls, and asbestos socks on his feet.

Steeldraulic Brakes Have European Outlet

CLEVELAND, Feb. 18—The Midland Steel Products Co. has completed arrangements with Denes & Friedman (Defag Corp.), Vienna, for the manufacture and sale of Midland Steeldraulic four-wheel brakes in Europe. The European concern has plants in Austria, Germany and France. The company, which is known as the Defag Corp., represents a number of leading American automotive manufacturers.

According to Herr Friedman, Europe is rapidly turning to the automobiles embodying standardized parts. He forecasts a large market abroad.

Registered Motor Boats In U. S. Show Gain

There was a gain of 10,083 officially numbered and recorded motor boats in the United States in 1931, according to the Commerce Department's Bureau of Navigation. The total as of Dec. 31, 1931, was 258,531, compared with 248,448 at the end of 1930 and 148,482 at the end of 1921.

There were 35,403 registered motor boats in New York; Tampa, Fla., was second with 22,290; Philadelphia third with 15,685; Baltimore fourth with 15,588; Norfolk fifth with 14,318, and New Orleans sixth with 14,020.

The number of registered motor boats has increased steadily since 1919 when there were 91,779 in the United States.

Plastic Cellulose Under Production

LONDON, Feb. 12—The Imperial Chemical Industries has put into production a new plastic material styled benzyl cellulose, which is secured by the action of caustic soda and benzyl chloride on cellulose.

Its outstanding property is its chemical stability; it resists alkalis up to 20 per cent concentration and is unattacked by sulphuric acid of storage battery strength. Its specific gravity is upward of 1.4; it is thermoplastic and can be heated up to 180 deg. Cent. without fear of decomposition.

It is also non-inflammable, can be worked at high temperatures without danger and has almost complete re-

sistance to water, its hygroscopicity being 0.5 per cent.

The new plastic is put forward as a basis of molding materials, lacquers, enamels, dopes, linoleum substitutes, celluloid, safety glass fittings, insulating compositions, etc., and can be supplied transparent or in any color.

Employment Up In Michigan

DETROIT, Feb. 17—Employment in the state of Michigan during January was 163,511 against 149,563 in December and 181,563 in January last year based on the reports of 75 companies. The aggregate weekly payroll was \$4,025,256 in January, \$3,971,038 in December and \$3,009,117 in January last year. Average weekly earnings per capita were \$24.62 in January, \$26.55 in December and \$16.57 in January last year.

S.P.-A. Export Promotes Spencer

H. P. Spencer has been appointed to the Brussels staff of the European organization of the Studebaker Pierce-Arrow Export Corp. He was formerly in the services of the corporation, having acted as treasurer of Studebaker Automobil G.m.b.H., Hamburg, Germany, during 1929 and 1930.

Simms Organizes Canadian Company

TORONTO, Feb. 12—Simms Motor Units of Canada, Ltd., has been organized by Simms Motor Units, Ltd., of England, to manufacture batteries and other automotive lines in a new plant at Toronto for the Canadian market and for export to other British Dominions and South America.

Canadian raw materials to the extent of 85 per cent are being used in the production of the batteries.

Hall Lamp Loss Reduced

DETROIT, Feb. 15—C. M. Hall Lamp Co. reported net loss of \$275,218 after all charges including non-recurring charge of \$246,931 for the year ended Dec. 31.

Actual operating loss during the year amounted to \$28,287. This compares with a net loss of \$43,741 for year ended Dec. 31, 1930.

Current assets as of Dec. 31, 1931, were \$1,148,764 against current liabilities of \$25,945, a ratio of 44 to 1. Cash and equivalent was \$688,288 against \$1,052,400 in 1930.

The company has 400,000 shares of no par capital stock outstanding.

German Ford Omits Dividend

NEW YORK, Feb. 18—Ford Motor of Germany omitted the dividend due at this time. The last previous payment was 10 per cent, paid March 14, 1931.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

NEW YORK, Feb. 18—The level of general trade last week remained from quiet to fair. However, recent developments have tended to establish a moderately improved confidence in business quarters.

The creation of the Reconstruction Finance Corp. has given the country the possibility of the release of large sums of frozen bank credit. A proposed amendment to the Federal Reserve Act, which has been received favorably thus far, would give to the Federal Reserve banks authority to extend vastly their rediscount powers. However, it is the general opinion that sound recovery must take the form of a gradual progress.

RETAIL SALES

The Federal Reserve Board's index of department store sales for January, with allowances made for both the number of business days and seasonal changes, stood at 80, as against 81 for December and 83 for November.

CAR LOADINGS DOWN

Railway freight loadings during the week ended Jan. 30 totaled 561,157 cars, which marks a decrease of 1781 cars below those during the preceding week, a decrease of 153,240 cars below those a year ago, and a decrease of 337,673 cars below those two years ago.

N. Y. STATE EMPLOYMENT OFF

New York state factory employment during January decreased about 4 per cent, while payrolls dropped more than 5 per cent. The total of factory workers in January was 14 per cent below that a year ago and 29 per cent below that two years ago.

ELECTRIC PRODUCTION

Production of electricity by the electric light and power industry in the United States during the week ended Feb. 6 was 5.4 per cent below that a year ago.

CRUDE OIL

Average daily crude oil production during the week ended Feb. 6 amounted to 2,152,700 bbl., as against 2,170,800 bbl. for the preceding week and 2,116,500 bbl. a year ago.

FISHER'S INDEX

Professor Fisher's index of wholesale commodity prices for the week ended Feb. 13 stood at 63.6, as against 64.2 the week before and 64.5 two weeks before.

BANK DEBITS

Bank debits to individual accounts outside of New York City during the week ended Feb. 10 were 25 per cent below those a year ago.

STOCK MARKET REVIVES

The stock market during the first part of last week showed renewed recession. However, the news regarding the proposed amendment to the Federal Reserve Act brought on a sensational recovery on Thursday, with prices rising from 2 to 15 points and the volume of trading doubling. Most issues closed the week with net gains. The call money rate remained at 2½ per cent.

FEDERAL RESERVE

The consolidated statement of the Federal Reserve banks for the week ended Feb. 10 showed decreases of \$36,000,000 in holdings of discounted bills and of \$8,000,000 in holdings of government securities. Holdings of bills bought in the open market increased \$13,000,000. The reserve ratio on Feb. 10 was 67.6 per cent, as against 67.1 per cent a week earlier and 67.4 per cent two weeks earlier.

Motor Wheel Conserves Cash, Omits Dividend

DETROIT, Feb. 15—Motor Wheel Corp. directors voted Tuesday to omit the first quarter dividend "due to increasing inventory requirements necessary for greater production and to preserve a conservative cash position." This is the first time since the incorporation of the company in 1920 that regular quarterly dividend has been omitted.

The report states that all departments of the Lansing plant are operating on greatly increased production schedules with February requirements running well ahead of January shipments.

Books \$100,000 Orders

MILWAUKEE, Feb. 12—Orders valued at close to \$100,000 for special milling machinery have been placed with the Davis & Thompson Co. by a large automobile manufacturer. The concern devotes itself largely to especially designed high production milling units but is branching out into the drilling machine field. It has just completed delivery of an order for six special drills to the Ford Motor Co., a large user of its milling tools. The drills are designed for automatically removing metal in the balancing of crankshafts.

Lewis Leeds Tatum

Lewis Leeds Tatum, formerly assistant chief engineer and later chief purchasing agent of Cutler-Hammer, Inc., Milwaukee, died Feb. 7 at the age of 58 years. He retired in 1930 because of failing health. A graduate of Cornell, Mr. Tatum was associated with the Bullock Electric Mfg. Co., Norwood, Ohio, from 1897 to 1906, when he became assistant chief engineer of Cutler-Hammer. In 1923 he was placed in charge of all purchases. He was a fellow of the American Institute of Electrical Engineering.

Charles Chalmers

Charles Chalmers, 51, a pioneer automobile manufacturer, was found dead on Feb. 14 in his home in Mt. Airy, Philadelphia.

At one time Mr. Chalmers was president of the Chalmers Motor Co., an organization he founded with his brother, Hugh Chalmers, now of Detroit. The firm later was taken over by the Chrysler organization and both brothers are said to have been heavy stockholders in this company.

Buick Produces 6350

DETROIT, Feb. 15—Buick Motor Co., Flint, Mich., has reported January production of 6350 cars, compared with 8140 in December and 5956 in January, 1931.

Canadians Study Trade of Empire

Grossman Names Body to Prepare Recommendations for Economic Conference

TORONTO, Feb. 18—D. R. Grossman, president, Canadian Automobile Chamber of Commerce, announces the organization will conduct a survey of the Canadian automobile export and import trade to prepare recommendations to the Imperial Economic Conference, scheduled to open July 18 at Ottawa. The recommendations will deal particularly with the prospective development of Empire trade, Mr. Grossman, who is vice-president and general manager of the Studebaker Corp. of Canada, Ltd., announced.

Discuss Aero Overhauls

NEW YORK, Feb. 15—Major overhauls of aircraft engines after every 300 hours of use are found to be more economical than frequent top overhauls, Captain J. S. Dexter of the Standard Oil Co. of New York, told service executives here last week at their regular monthly meeting of the Automotive Service Association of New York. The importance of keeping aircraft and engines at 100 per cent efficiency was emphasized.

Col. H. W. Lake of the Vacuum Oil Co. analyzed the maintenance cost for commercial aviation operations and discussed proper accounting for such a system.

Goodyear of Canada Earns \$8.20, Common

TORONTO, Feb. 18—Goodyear Tire & Rubber Co. of Canada, Ltd., for 15 months ending Dec. 31, earned \$8.20 per share of common stock after preferred dividends totaling \$642,757.

Dividend requirements on common were \$6.25 per share, leaving approximately \$250,000 to be added to surplus account. The \$8.20 per share for the 15 months compared with \$8.02 for the previous 12 months.

Net profits totaled \$1,700,000, while total current assets were \$10,500,000. More than \$1,000,000 was set aside during the fiscal period for depreciation on buildings and equipment and total reserves are \$5,500,000.

Since the company's last report, rubber dropped to a new low level of 4¼ cents a lb., a decrease of more than 36 per cent, compared with the previous year.

Langmuir Builds Kari-Keen

TORONTO, Feb. 18—The Langmuir Mfg. Co. and Major J. H. Franklin, president of the distributing firm of Kari-Keen & Auto Trunks, Ltd., have become associated in the production in Canada of the Kari-Keen Karrier steel automobile trunks.

Men of the Industry and What They Are Doing

Allard Sales Head of Curtiss-Wright

John S. Allard, president, Curtiss-Wright Flying Service, has been named vice-president in charge of sales for the Curtiss-Wright Corp. He will coordinate the sales activities of all the subsidiary companies which include Wright Aeronautical Corp., Curtiss Aeroplane & Motor Co., Keystone Aircraft Corp., Curtiss-Wright Airplane Co., Curtiss-Wright Export Corp. and the flying service.

James of Hudson Is ABC Director

William A. James, director of advertising and promotion for the Hudson Motor Car Co. of Detroit, has been appointed a director of the Audit Bureau of Circulations as one of the thirteen representatives of national advertisers on that board, according to announcement by P. L. Thomson, president of the bureau.

Mr. James succeeds the late M. L. Rigby of the Studebaker Corp. as representative of the motor car interests on the board, which consists of twenty-five men.

Noorduyn Joins Pitcairn

R. B. C. Noorduyn, formerly vice-president of the Bellanca Aircraft Co., New Castle, Del., has become affiliated with Pitcairn Aircraft, Inc., as executive engineer.

Thien Leaves G. M. Export

Because of his desire to reenter domestic advertising and merchandising, Robert R. Thien, assistant general sales manager of General Motors Ex-

port Co., has resigned as of Feb. 1. Mr. Thien joined the company five years ago as manager of the advertising division and has been assistant general sales manager for two years.

Robertson Leaves for Turkey

Major William B. Robertson, St. Louis aeronautical expert, sailed last week for Turkey to supervise the laying out of airways under a contract between the Turkish Government and the Curtiss-Wright Corp. He was a World War aviator, was the first employer of Charles A. Lindbergh and backer of the latter's original efforts to finance the flight to Paris.

FWD Executive Sails

J. D. Cotton, vice-president, Four Wheel Drive Auto Co., accompanied by Mrs. Cotton, will spend several months in South America in the interests of his company.

Bliss Made Nash Director

The election of C. H. Bliss, vice-president in charge of sales of the Nash Motors Co., to membership in the company's board of directors was announced.

Steel Promoted

A. W. Steel has been appointed manager of the Oldsmobile New York zone. For the past four years he has been Metropolitan district manager for the company.

Boeing Executive on Trip

Gardner W. Carr, plant manager of the Boeing Airplane Co., is completing a business tour of the East.

U. S. Advertising Corp. Is 3-Company Merger

NEW YORK, Feb. 15—Announcement was made today of the organization of the United States Advertising Corp. with offices in New York, Chicago, Toledo, Milwaukee and Indianapolis, and associate offices in important market centers throughout the world.

Ward M. Canaday, president of the present United States Advertising Corp., New York and Toledo, becomes president and the executive head of the new company, and Homer McKee, president of The Homer McKee Co., Inc., of New York, Chicago and Indianapolis, becomes executive vice-president of the new company. George Enzinger, president of the Dyer-Enzinger Co. of Chicago and Milwaukee,

becomes president of the Chicago division.

The United States Advertising Corp. starts operation immediately with more than seventy accounts of national advertisers and will rank as one of the largest and strongest agencies in the advertising field.

Crude Consumption at Par

NEW YORK, Feb. 15—Consumption of crude rubber by manufacturers in the United States for January amounted to 27,962 long tons as compared with 21,409 long tons for December, 1931, and represents an increase of 30.6 per cent, which is about seasonal, according to statistics released by The Rubber Manufacturers Association today.

Imports of crude rubber for the

month of January were 31,298 long tons, a decrease of 39.7 per cent under the December figure and 15.6 per cent below January a year ago.

This association estimates total domestic stocks of crude rubber on hand Jan. 31 at 322,860 long tons, which compares with Dec. 31 stocks of 322,826. While January stocks show practically no change as compared with December, they were 54.1 per cent above stocks the same date last year.

Crude rubber afloat for the United States ports on Jan. 31 amounted to 77,244 long tons as compared with 53,940 long tons on Dec. 31 and 56,188 long tons on Jan. 31, 1931.

Franklin Business Gaining

Increased business in shipments and retail deliveries is reported by the Franklin Automobile Co. December retail deliveries were well ahead of December a year ago and the company got a bigger share of the fine car market than in any month in its 31-year history. Shipments in January were 34 per cent ahead of the corresponding month of last year and forecast for February indicates that this month will pass last February.

Kinner R-5 Engine

GLENDAL, CALIF., Feb. 15—The Kinner Airplane & Motor Corp., Ltd., announces type R-5 to their line of engines. This engine has been approved by the Department of Commerce Aeronautics Branch, and has been granted Approved Type Certificate No. 77.

It is a five-cylinder radial air-cooled engine and is said to be the most efficient engine in its horsepower class now being manufactured in this country. It develops 160 hp. at 1775 r.p.m., with a compression ratio of 5 to 1 and a total piston displacement of 490 cu. in., and has an actual brake mean effective pressure of 134 lb. per sq. in. It is also the lightest aircraft engine in its horsepower class, weighing but 1.91 lb. per hp., or a total of 305 lb.

Production Above December

NEW YORK, Feb. 15—Production of passenger cars and trucks in the United States and Canada for January, 1932, has been placed at 126,518, according to the preliminary estimate of the National Automobile Chamber of Commerce. This compares with 123,965 in December, or an increase of 2.1 per cent, and with 178,344 in January of last year, or a decrease of 29 per cent.

Ryan on Gemmer Board

Mack Ryan, local attorney, was elected a director of Gemmer Mfg. Co., filling the vacancy caused by the death of W. N. Osborne. Other directors and officers were reelected.

Chrysler Earnings for 1931 Show Gain, Sales Up, and Directors Declare 25c

(Continued from page 269)

"Every factor to which experience gives any substantial weight indicates that the potential market for automobiles needs only this spark to restore to it increased activity.

"The accumulation of deferred purchasing is greater than ever, actual use of automobiles is steadily increasing and—what has even greater significance—there are today more cars over two years old and fewer cars under two years old than there were at the close of 1929."

Mr. Chrysler said the corporation not only had sold more cars at retail last year than in 1930, but also increased its profit on a smaller dollar volume of business and also had improved its relative position in the industry. Sales of its cars at retail last year were 16.6 per cent of all such sales by members of the National Automobile Chamber of Commerce, compared with 14.3 per cent in 1930. The number of automobiles of all makes sold last year was 27.3 per cent less than in 1930.

This table shows the company's income account for 1931 and 1930:

	1931	1930
Sales	\$183,805,104	\$207,789,338
Cost of sales	159,439,359	183,138,645
Gross profit	24,365,745	24,650,693
Other income	1,952,815	2,453,854
Total income	26,318,560	27,104,547
Expenses	20,944,951	23,729,032
Interest, etc.	*3,143,315	3,099,693
Federal taxes	118,414	41,667
Adj. for. subsid. assets	†642,945
Net income	1,468,935	234,155
Common dividends	4,412,240	11,065,268
Deficit	2,943,305	10,831,113
Total surp. Dec. 31	43,017,196	45,960,501

* Includes foreign exchange losses.

† Provision to reduce carrying value of net assets, except permanent assets of foreign subsidiaries to basis of exchange rates prevailing on Dec. 31, 1931.

Mr. Chrysler said: "Increased effect was given during the year to the corporation's continuing policy of economy in every phase of its operations, which, with efficiencies in manufacturing resulting from improved methods, rearrangement and consolidation of operating facilities and the closest scrutiny of all expenditures, enabled the corporation last year to make a material reduction in administrative, engineering, selling, advertising, service and general expenses. These items in 1931 amounted to \$20,944,951, compared with \$23,729,032 in 1930, a reduction of \$2,784,080, or 11.7 per cent.

"A non-recurring charge of \$642,945 has also been made against income to reflect the lower foreign exchange rates prevailing as of Dec. 31, 1931. As in previous years, and in accordance with the corporation's consistent practice, all expenses incident to the creation of new models were charged against current operations.

"The balance sheet as of Dec. 31,

1931, shows a substantial improvement in the corporation's financial condition as compared with that of the previous year-end."

Current assets on Dec. 31, 1931, totaled \$76,320,110, including \$23,200,862 cash and \$27,031,974 in marketable securities. This compared with current assets of \$74,028,993 at the end of 1930, including cash of \$32,145,400 and marketable securities of \$9,498,991. Current liabilities at the end of last year were \$11,327,696, against \$11,454,731 at the end of 1930. Mr. Chrysler said the marketable securities were all short-term notes or bankers' acceptances, with the exception of \$100,000, and would mature this year. The indicated market value of these securities on Dec. 31 was \$103,561 less than cost. The corporation's deposits in closed banks amounted to \$237,454, of which \$37,454 already had been collected.

The company purchased \$3,171,500 of Dodge Brothers debentures last year, although the maximum sinking fund requirements on the issue are only \$500,000 semi-annually.

Lincoln Sales Break Records

DETROIT, Feb. 18—Paralleling records set at the New York and Detroit shows, retail sales of new Lincoln motor cars at the Chicago automobile show were the greatest in the history of the Lincoln Motor Co.

Sales of 58 units, including both eight-cylinder and 12-cylinder Lincolns, were reported. Increases in volume over 1931 are being recorded at other shows and salons throughout the United States, it was said.

Boeing Ships Army Craft

SEATTLE, WASH., Feb. 15—At the end of February the Boeing Airplane Co. delivered 98 pursuit planes on its contract with the Air Corps for P-12E aircraft, and the entire order will be finished in April. Largest single delivery of planes on the contract took place Feb. 1, when fifteen P-12E's, flown by Army flight officers, took off from Seattle to ferry the planes east to the Mt. Clemens, Mich., air base.

Departure of seven more P-12E's for Selfridge Field completed delivery of pursuits to this Air Corps base on the current Boeing contract. Remaining pursuits will be flown south to Mather and March Fields in California.

New Engineering Cooperation

CINCINNATI, Feb. 14—The Cincinnati Milling Machine Co. and its subsidiary, Cincinnati Grinders, Inc., of Cincinnati, and the Heald Machine

Co. of Worcester, Mass., have concluded a cooperative arrangement which will be mutually advantageous in the further development of their respective lines of manufacture. These companies have for a long period of years made many valuable contributions to the industries they serve and they believe that by making the engineering research and grinding knowledge of each company available to the engineers of the others, a more complete service in internal and external grinding can be rendered to all users.

To Substitute Buses for Rails

ROME, Feb. 18—The Italian government authorized the Minister of Communications to modify services on the government rail lines and was empowered to replace trains with automobile service, according to U. S. Trade Commissioner A. A. Osborne.

Automobile services, instituted in accordance with this new measure, may be operated by either the State Railways Administration or private organizations. Bus lines supplementing rail service may also have their operation entrusted to the management of the railways. On routes over which the railway administration operates automobile services the government will have exclusive working rights.

Fate-Root-Heath Adds 3 Diesels

PLYMOUTH, OHIO, Feb. 18—The Fate-Root-Heath Co. of this city has recently added three new models of Diesel locomotives to its line of 6, 8 and 10 tons rating respectively. These locomotives are equipped with Cummins Diesel engines of the three, four and six-cylinder type respectively, and of 36, 48 and 72 hp. Plymouth Diesel locomotives are now made in capacities of from 6 to 80 tons.

Johnson Firm Incorporates

RACINE, WIS., Feb. 17—After doing business as a partnership for 40 years, the firm of S. C. Johnson & Son, manufacturing waxes and finishes for automobiles, etc., has been incorporated as S. C. Johnson & Son, Inc. The principal ownership remains in the Johnson family.

Omits First Quarter Dividend

LANSING, Feb. 18—Directors of Motor Wheel Corp. voted to pay no cash dividend on March 1 for the first quarter of 1932, because of increased requirements for greater production schedules and to preserve the company's conservative cash position, Clarence C. Carlton, secretary, said.

Saxony Bids for Big Share of German Car Production

Proposed Merger of D.K.W., Audi, Horch and Wanderer Expected Official Approval

by U. S. Vice-Consul Howard Elting, Jr.

DRESDEN, Feb. 12—A definite bid by the State of Saxony for a large share of German automobile production is seen in a recent announcement by that government of the merger of D.K.W., Audi, Horch and Wanderer.

According to the plans, which are to be submitted to and approved by the Landtag, the new company will be organized with a capital of \$3,808,000, a third representing the stock capital of the companies (not including Wanderer) after the reorganization.

A third will be assumed by a limited liability company, guaranteed by the state (for which the formal consent of the Landtag is necessary) and taken over by the banks which have backed the firms to date.

The Wanderer Werke will bring about 8 per cent, while the remaining capital will be made up by public participation.

The liability company will be guaranteed by all the interested banks which will form themselves into a consortium headed by the Saxon State Bank, a government-backed institution. Since the liability company will take over \$1,000,000 in stock of the merged firms, and the consortium guaranteeing the liability company is headed by the State Bank, it seems reasonably clear that the whole enterprise is a form of state subsidy.

By lending support to the merger, the government will concentrate an important section of the German automobile industry in Saxony. Considerable sacrifices are being made by the interested banks, while the city of Chemnitz has promised to aid by a reduction of taxes, to permit the merger.

Factories and branch shops of the companies outside of Saxony will be centered in this state and manufacturers of parts may find it to their advantage to move, or at least set up branches there.

All this, with the contemplated concentration of purchasing, advertising and administration in Saxony, probably at Chemnitz, would indicate important benefits for the area in increased employment and potential purchasing power. Further, it will mean the end of ruinous competition among Saxon automobile companies, since all except the Phänomen Co. of Zittau are involved, and it is considered likely that the latter will eventually be included.

Thus, Saxony will take its place as an important automobile center, able to compete in world markets as a re-

sult of the expected reduction of production costs by 4 or 5 per cent.

"Saxony" probably will not appear in the name of the new company. The United Automobile Co. has been suggested as likely.

Contemplated changes include the transfer of the Wanderer body works from South Germany to the Horch works in Zwickau, the latter having been far below capacity for some time.

D.K.W. will abandon their Spandau assembling plant for their front-wheel drive model brought out last year, and move into the Audi plant in Zwickau.

Indian Motorcycle Cuts 1930 Loss

SPRINGFIELD, MASS., Feb. 16—Indian Motorcycle Co., and its subsidiary, the Indian Acceptance Co., for the 12 months ended Dec. 31, 1931, report operating loss of \$392,346.20, as compared with loss of \$774,460.74 for the preceding year. Heavy write-offs, and additional reserves in the last quarter account for most of the loss reported, which is after providing for depreciation of the properties in the amount of \$117,028.84, shrinkage in inventory values mainly due to obsolescence and reduction in market values of \$114,214.14 and added reserves of \$114,878.66 against uncollectable accounts, a total for the three items of \$346,121.64.

Net sales for the year were \$1,575,272.57, as compared with \$2,167,088.45 for 1930.

Canadian Sangamo Production Begun

TORONTO, Feb. 18—Production of electrical equipment has been started at Toronto by the Wagner Electric Mfg. Co., Ltd., as a subsidiary of the Sangamo Co. The new operations in the name of the subsidiary follow the acquiring of exclusive Canadian manufacturing and sales rights by Sangamo of products of the Wagner Electric Corp., St. Louis, Mo., it is announced. The company has an investment of \$1,000,000 in Toronto and employs 200 workers here. Products have been exported to 18 countries.

Homs Distributes Lycoming

J. M. Hom, export manager of the Lycoming Mfg. Co., has been named metropolitan New York distributor for Lycoming marine engines. He will continue his duties as export manager.

Mills Seeking Stabilization

Producers Say Demand for Restoring Valid Quotations Is Pressing

NEW YORK, Feb. 18—The steel market is wondering whether producers are following traditional habit in planning announcement of higher second-quarter prices merely as a means of driving out more business at the prevalent lower levels or whether they are serious in their belief that the time has come when they can safely mark rolled steel prices \$2 to \$3 a ton upward without impairing the much needed growth of demand.

Chicago district bar mills contemplate 1.70 cents as the second-quarter quotation for steel bars and other heavy rolled products, an advance of \$2 a ton over the price at which business has recently been done.

The 1.50 cents, Pittsburgh, price is said to have resulted from temporary market upsets and that 1.60 cents is likely to take its place before long. A \$2 to \$3 per ton advance in sheet prices is forecast. Strips would naturally follow in the upward readjustment of prices.

Henry Ford's recent pronouncement that "if the material men begin to raise prices, the whole effort may be throttled" is answered by steel producers by emphasizing that what they have in mind is not the raising of prices, but the stabilization of the market and the restoration of valid quotations in place of those that serve as targets for every order-hungry seller to shoot at. It is rumored that some Ford releases have come through for sheets and strip steel, and Mahoning and Shenango valley mills anticipate a quickening of business for Ford account over the next six weeks.

Automotive alloy steel demand is spotty.

Pig Iron—Withdrawals by General Motors subsidiaries against blanket contracts are running satisfactorily. The bulk of the current demand from automotive foundries is in carload lots for immediate shipment. The market continues easy.

Aluminum—Middle West secondary metal interests report a fair increase in automotive demand this month over January. The primary market is devoid of new developments.

Copper—Pending the possible amelioration of the market's statistical position through further curtailment of output following discussions with South African producers, whose spokesmen are en route for New York, activity is very light. Electrolytic continues to be quoted at 6½ cents, delivered Connecticut. Prices for wire and other copper and brass products early this week were based on 6½ cent copper.

Tin—Advances in London caused Straits to be quoted at 22¼ cents at the opening of the week, denoting ½ cent advance over a week ago.

Lead—Demand from storage battery manufacturers is somewhat better. Price unchanged.

Zinc—Steady and unchanged.

Truck Study Begun By Traffic Heads

N. A. C. C. Committee Named to Investigate Restrictive Legislation

DETROIT, Feb. 15—Traffic managers of the National Automobile Chamber of Commerce yesterday voted to establish a special Highway Transportation Committee to study the use of trucks by the industry and the effect of present regulations and new proposals.

Keen interest was shown in efforts that are being made to restrict the handling of freight on the highways by Federal and state legislation. The Michigan situation, wherein the movement of trucks from adjoining states is being interfered with through a non-reciprocal attitude of the Highway Commission, is being reflected in retaliatory measures on the part of other states.

Federal legislation as proposed by Attorney-Examiner Flynn of the Interstate Commerce Commission and in bills now before Congress would add further difficulties to the handling of materials and supplies on the highways, which has reached a large volume in factory operations as a necessary adjunct to the large volume of business moved to the plants by the railroads, it was said.

The following were appointed on the committee: Mr. C. R. Scharff, Director of Traffic of Chevrolet Motor Co., chairman; J. H. Myler (Chrysler), E. J. Klebba (Lincoln), F. A. Allen (Hudson), and V. Laird (Auburn).

Reports indicated that the Johnson Bill, which was recently introduced in Congress through the influence of the Shipping Board, was referred back by the Senate committee for rewriting.

It is expected that this bill will reappear shortly in a form to give the Shipping Board the right to regulate intercoastal rates and services, which would be a new departure in governmental control of transportation, which heretofore has not extended to ocean rates.

A special committee of the traffic managers is studying the proposal that has been made by an Interstate Commerce Commission Examiner to deny shippers the right to route freight over lines of their own selection. In the investigation of reciprocal purchasing, the examiner reports the routing of freight as playing an important part in the railroads' purchasing of materials. There is a decided feeling among shippers that the suggestion to eliminate all routing control is radical and unjustified and would lead to serious complications through leaving the routing

privilege entirely with the initial railroads.

Twenty-five of the chief traffic executives of the railroads, headed by Eugene Morris, chairman, Central Freight Association, met the N.A.C.C. traffic group on Wednesday afternoon to discuss automobile shipping and the special commodity tariffs that were made effective a year ago. These tariffs were published to meet the competition of motor trucks in hauling cars to dealers, and being an experiment in rate making and a departure from the ordinary schedules, were limited to expire on April 10. The plan has not been entirely successful from the rail viewpoint although data submitted at the meeting indicated considerable benefit to the railroads.

The Central Freight Lines, on which most of the automobile traffic originates, voted at the meeting to renew the arrangement for another year and it was expected that western and southern lines will take similar action.

Factories represented at yesterday's meeting included: Auburn, Buick, Checker Cab, Chevrolet, Chrysler, Dodge, Federal, General Motors, Graham-Paige, Hudson, Hupp, Lincoln, Oakland, Olds, Reo, Studebaker, and K. A. Moore, N.A.C.C., and J. S. Marvin, chairman of the conference.

Regional Association Formed

NEW YORK, Feb. 15—Motor and Equipment Wholesalers Association held a meeting last week in Chicago of automotive wholesalers in Michigan, Eastern Wisconsin, Northern Illinois and Northern Indiana, at which was formed a regional association to be known as the Great

Lakes Automotive Wholesalers Association, which will function under the auspices of the Motor and Equipment Wholesalers Association.

Railroads Buy Iowa Pickwick

DES MOINES, IOWA, Feb. 16—The Interstate Transit Lines, owned by the Chicago & Northwestern and Union Pacific railroads, have acquired all Pickwick-Greyhound motor bus lines in Iowa for a reported price of \$193,608, including not only existing franchises but considerable equipment and station facilities.

Franklin Employment Up

SYRACUSE, N. Y., Feb. 15—The number of employees at the plant of H. H. Franklin Mfg. Co. exceeds the highest total of last spring, when peak production for the year was being maintained. The payroll last week was \$37,000, a new high figure for many months.

Further addition to the working force will be made as soon as the lay-out of the new body plant is finished and actual production commences.

Gunite Consolidates Two

NEW YORK, Feb. 15—Gunite Corp., Rockford, Ill., has been consolidated with the Rockford Northwestern Malleable Corp. under the name of Gunite Foundries Corp.

Budd Wheel Profits

NEW YORK, Feb. 15—Budd Wheel Co. reports net profit for the year 1931 of \$182,674, or 10 cents a share on common stock.

+ + CALENDAR OF COMING EVENTS + +

SHOWS

Salon, Los Angeles, Calif. Feb. 13-20
Kansas City, Automobile. Feb. 13-20
Mankato, Minn., Automobile. Feb. 17-20
Peoria, Ill., Automobile. Feb. 17-21
Holyoke, Mass., Automobile. Feb. 18-22
Des Moines, Iowa, Automobile. Feb. 21-26
Wichita, Kan., Tractor and
Power Equipment Feb. 23-26
Salon, San Francisco, Calif. Feb. 27-Mar. 5
Albany, N. Y., Automobile. Feb. 27-Mar. 5
Berne, Switzerland, Automobile. Mar. 11-20
National Aircraft, Detroit, Mich. Apr. 2-10

FOREIGN SHOWS

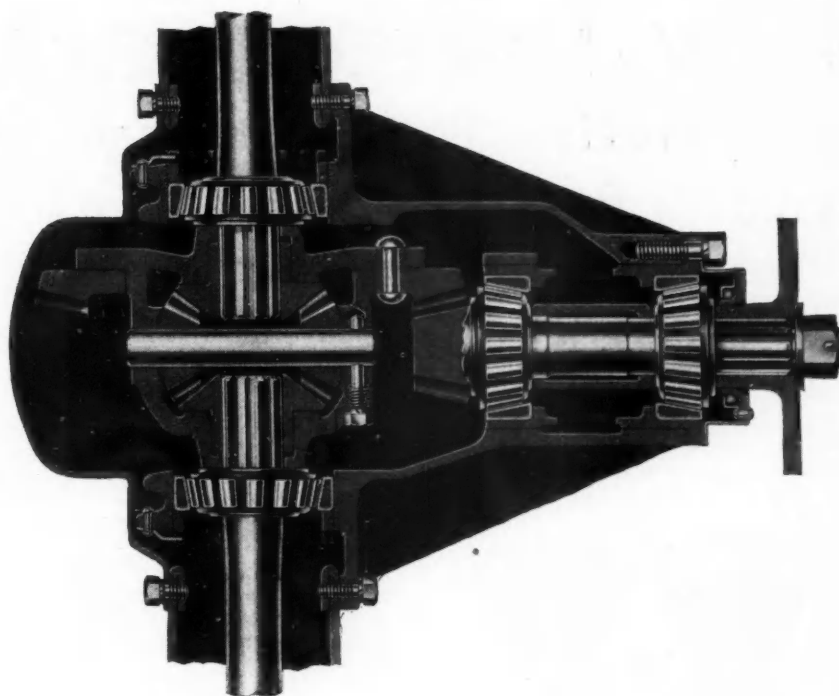
Copenhagen, Automobile. Feb. 26-Mar. 6
Lyons, France, Passenger and
Commercial Mar. 7-20
Geneva, Switzerland, Passenger
and Commercial Mar. 11-20
Vienna, Passenger and
Commercial Mar. 13-20
Tel Aviv, Palestine (Levant
Fair) April 7-30
Milan, International Automobile
Salon April 12-27

Zagreb, Yugoslavia, Automobile
Salon April 23-May 2
Poznan, Poland, International
Fair May 1-8
Dublin, Commercial May 4-7
Budapest, International Fair. May 7-16
Belfast, Commercial May 25-28
Bordeaux, Fair June
Cork, Commercial June
Inverness, Commercial June 21-24
Southampton, Commercial July 5-9
Llandrindod, Wales,
Commercial July 20-22
London, Olympia Show Oct. 13-22
Glasgow, Scottish Motor Show. Nov. 11-19

CONVENTIONS

Southern Automotive Jobbers
Asso., Atlanta, Ga. Mar. 16-19
U. S. Chamber of Commerce,
San Francisco, Calif. May 16-20
National Battery Mfrs. Asso.,
Chicago, Ill. May 19-20
American Welding Society, Annual Meet-
ing, New York City. Apr. 27-29

Timken Tapered Roller Bearings for quiet rear axle performance



Quiet-running rear axles have become doubly important since the general adoption of free-wheeling. Noises which the car driver previously could not detect, assert themselves in a most annoying manner when the car is running free, especially at fairly high speeds.

Leading car manufacturers have long recognized the value of Timken Tapered Roller Bearings in contributing to quiet rear axle performance. With the differential and pinion as-

semblies supported on Timkens, shafts are maintained in alignment under all operating conditions.

Gears can be installed with extreme precision contact—and held to that contact permanently. Full protection is assured against radial, thrust and combined loads; high motor torque; and extreme speed.

The list of modern cars with Timken-equipped differentials and pinions tells its own story of Timken superiority at these vital points.

	Pinion	Differential		Pinion	Differential
Auburn	x	x	Hupmobile	x	x
Austin	x	x	Jordan	x	x
Cadillac	x	x	Kissel	x	x
Chrysler	x	x	LaSalle	x	x
Cord	x	x	Lincoln	x	x
Cunningham	x	x	Marmon	x	x
DeSoto	x	x	Nash	x	x
De Vaux	x	x	Peerless	x	x
Dodge	x	x	Pierce-Arrow	x	x
DuPont	x	x	Plymouth	x	x
Durant	x	x	Reo	x	x
Elcar	x	x	Rockne	x	x
Essex	x	x	Studebaker	x	x
Ford	x	x	Stutz	x	x
Franklin	x	x	Willys	x	x
Graham	x	x	Willys-Knight	x	x
Hudson	x	x			

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

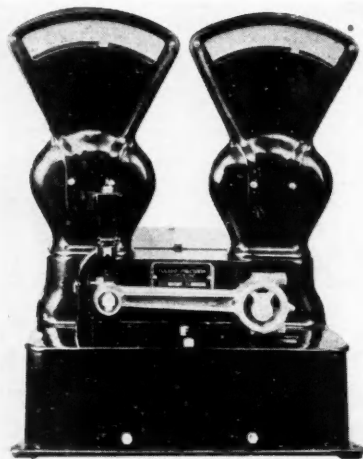
TIMKEN *Tapered Roller* BEARINGS

NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

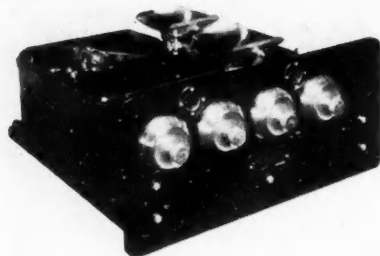
Gage for Connecting Rods

Toledo Precision Devices, Inc., subsidiary of the Toledo Scale Co., Toledo, Ohio, has announced a new connecting-rod testing auto-gage, consisting of two separate machines. One per-



forms the initial weighing of the connecting rod. Formerly, each end of the connecting rod had to be weighed separately. With this device, both ends are attached, at the same time, to two instruments mounted side by side, as shown in Fig. 1. The two charts then register simultaneously the amount of overweight in each end of the rod.

After the amount of overweight has been ascertained, the operator sets the dials of the machine in Fig. 2, to coincide with the figures on the charts. This machine consists of two in-



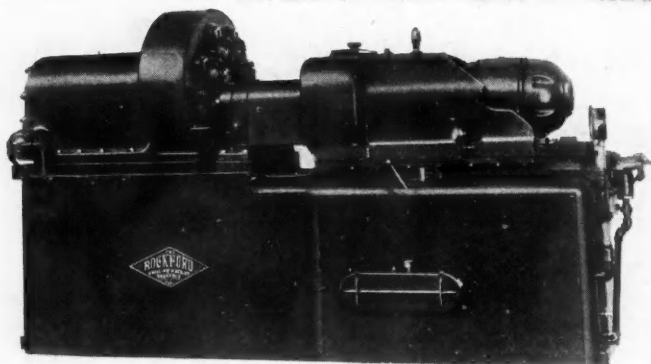
struments with receiving pans. An automatic cut-off device is connected with a shaving machine placed next to it. The connecting rod is placed in the shaving machine and pared to the proper diameter, at which point the automatic cut-off stops the operation.

In production, both machines can be operated by one man. While one rod is being shaved to the required proportions, another is weighed. As soon as it is weighed, the operator sets the outside dials on the second machine to the points registered by the dials on the first. These two dials have no connection with the machine, but are merely set to eliminate errors due to the human element. As the shaving process is completed on one rod, the operator sets the two inside dials to coincide with the outside dials, and the

New Rockford Automatic

Here is another cost reducing adaptation of equipment made by the Rockford Drilling Machine Co., Rockford, Ill. The main feature of this machine is the automatic operation of both the machine head and the indexing drum fixture, reducing the operator's duty to merely that of loading and unloading parts. The speed of the machine is adjusted to the ability of the operator. The operations performed on the housing consist of burnishing the face around the bore, also cutting the groove into this face.

Two parts at a time are loaded and



unloaded at the idle stations, of which there are two for the convenience of the operator. While this takes place, two parts at the first working station have the oil groove cut in them, and two parts at the second working station, previously grooved, are burnished. The machine head feeds forward at the correct rate, cuts the groove, builds up pressure for the burnishing operation, and then returns to the starting position. At the same time the fixture drum automatically indexes one station, locates itself accurately, and the cycle is repeated. The

second rod is placed on the shaving machine. In this way, both machines operate continually and one man performs more efficiently what was formerly the work of two.

Trulay Armored Cable

A new push-and-pull control mechanism of the general type of the Bowden wire mechanism has been placed on the market by the American Cable Co., Bridgeport, Conn., and already has found extensive application in the industry for ride control and free-wheeling control. It consists of a Trulay armored cable within a flexible conduit. The armoring of the cable extends over its entire length, but is different in character inside and outside of the conduit. Over that portion of the cable which remains constantly within the conduit the armoring is so wound that the cable is flexible, while those parts of the cable which extend from the ends of the con-

(Turn to page 280, please)

machine continues to function in this manner until stopped. The operator, as previously pointed out, merely continues to load and unload. A seven second cycle is possible, though this may be slowed up to suit the speed of the operator.

All functions of feed and indexing of the drum are secured through means of Oilgear hydraulic pump. Ways, guide bushings for guiding the tooling, and all working parts in machine head are automatically lubricated.

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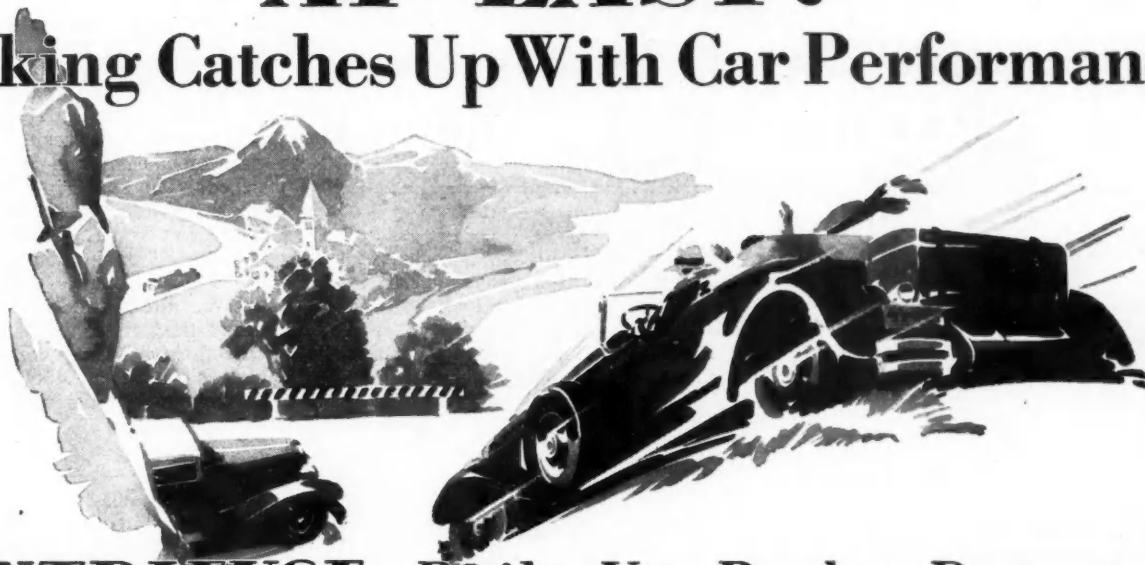
corporated for the operations noted above, mounted in Timken bearings. The special grooving and burnishing tools are guided accurately by bushings carried in a separate bracket mounted on machine base. The Indexing Fixture Drum is mounted in large Timken bearings, and is operated hydraulically, locating itself accurately at each station.

Guards are provided wherever necessary, and the machine can be stopped quickly at any point of the operation cycle.

(Turn to page 280, please)

AT LAST!

Braking Catches Up With Car Performance



CENTRIFUSE Built-Up Brake Drums of Revolutionary Construction ... *Heat Dissipating ... Noiseless ... Self-Truing ...* Keeping Safe Working Adjustment **More Than 5 Times as Long**

Automobile brakes had plenty to do and needed plenty of service attention when they had to cope only with increasing car speeds, mounting traffic congestion, quicker stops and new driving standards.



Then came Free Wheeling, demanding still more brak-

Look for

these points they identify the CENTRIFUSE Drum

Built-up construction—steel ring for strength, fused iron braking surface for unchanging efficiency—welded steel back for quick heat dissipation.

ing efficiency, shortening the service life of brake drums and linings still further, making lining renewal and drum reboring or replacement still more frequent than they were with steel drums.

These new, serious conditions are now more than met by the CENTRIFUSE, the new brake drum of revolutionary construction. CENTRIFUSE Brake Drums provide the greater braking power and the dependability needed for present-day car performance and driving habits through a *new basic operating principle*.

This new principle is inherent in two features of CENTRIFUSE drums. The first is a compact, non-

scoring iron braking surface fused, by centrifugal force, into a steel foundation ring; the second feature, *found only in CENTRIFUSE* drums, is the unique built-up construction in which a tailor-made steel back of individual specifications is joined to the "centrifused" braking ring.

New 1932 car models—*Auburn, Chrysler, De Soto, Dodge and Graham*—have CENTRIFUSE Brake Drums as standard equipment. Inspect the cars with the new safety brake drum that maintains safe brake adjustment more than 5 times as long.

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Quick Facts About **CENTRIFUSE** Brake Drums

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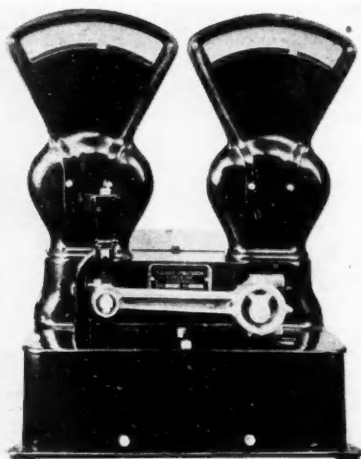
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NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

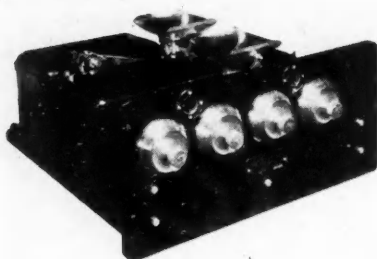
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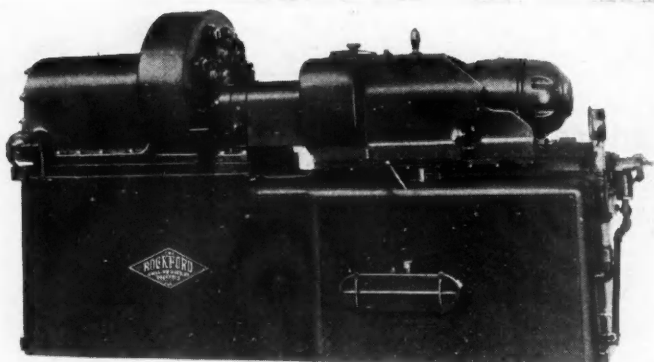
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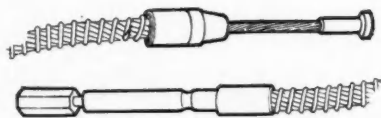
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NEW DEVELOPMENTS

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duit are rigid, this rigidity being due to the method of application of the armoring.

The rigid end of the cable is provided with a spherical enlargement sliding in the end of the conduit, this arrangement allowing it a certain an-



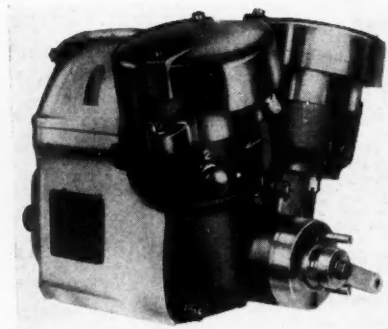
gular freedom so it can freely follow the motion of the lever end to which it is connected. The conduit is waterproof and grease-tight. It is packed with grease when being installed, and this one application of lubricant is said to be sufficient for the life of the car. Any type of fitting can be applied to the ends of the flexible cable.

These controls are applicable also as throttle controls, choke controls, etc., on airplanes.

Bosch Ignition Magnetos

At the New York automobile show the United American Bosch Corp., Springfield, Mass., exhibited a new line of ignition magnetos developed by Robert Bosch A.G. for use on buses, trucks and other gasoline-burning powerplants in heavy-duty, fast service.

The new line, to be known as the Rapid-Transit magnetos, includes three types of six-cylinder machines, viz., the JR-6, which is for use on engines with a single ignition sys-



tem; the JRD-6 which is equipped to furnish dual ignition through one set of spark plugs; and the JRZ-6, for dual ignition through two sets of spark plugs operating simultaneously.

Among the unusual features of the new magnetos are the following: Dis-

tribution of the high-tension current by means of a timer-type distributor mounted at the rear end of the magneto; a stationary interrupter operated at one-half engine speed, or one-third the speed of the conventional type, with consequent reduction in wear; a stationary winding of large

Sunstrand Brake Drum Splitting Machine

One of the interesting developments in brake drum design is the centrifugally cast lining in a rolled steel shell. In one case the manufacturer makes the shell from special section, double width rolled steel. This is cut off to length, rolled to the form and electrically welded, after which the cast alloy iron is centrifugally cast into the rolled section. It is then split or parted making two brake drums.

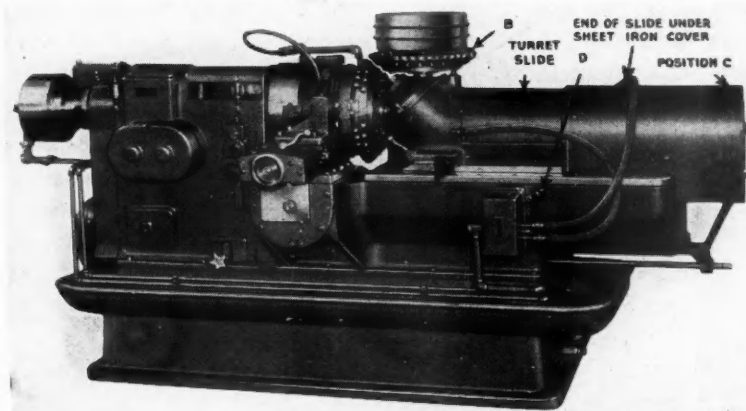
The advantage in handling the material in double width sections through the centrifugal casting operation is that the symmetrical section

size which is said to deliver sparks of unusual intensity.

A spare interrupter is provided on the JRD magneto for use with battery ignition in case trouble should develop with the magneto generating elements. By simply inserting one high-tension lead and turning a control knob, the battery becomes the source of current and the vehicle can proceed. The spare interrupter is inoperative when the other is in service, and vice-versa. Both interrupters are operated by individual cams. Another feature of the JRD and JRZ types is automatic advance. It is claimed that these magnetos can be operated with safety continuously at speeds as high as 4500 r.p.m., and that they also have good low-speed characteristics.

parts are held securely, thus eliminating any possibility of tool breakage.

This view shows the machine with slides in the forward position, the drum having been split. The slides then automatically return on rapid traverse to the loading position. The movement of the slides releases the air and causes the chuck to open, the movement of the chuck draw rod automatically operating a limit switch and causing the spindle to stop. When the cut-off slides are fully returned, Valve "D" is automatically operated causing the turret slide to return to position "C," at which position turret "B" automatically indexes 180 degrees, bringing the two halves



material is much easier rolled and also because the flanged edges prevent the molten metal from being thrown out during the centrifugal casting operation.

To take care of the unusual machining requirements of this job, the Sunstrand Machine Tool Co., Rockford, Ill., has developed the machine shown in the illustration. In operation, the shell is placed on the loading platform and work carrier B. He then turns the carrier by means of a knurled ring which operates a 3-jaw scroll chuck gripping the piece lightly from the inside so that after the parting tools have split the assembly, both

to unloading position and the assembly to chucking position.

Four "J"-Metal tools are used for the cutting off operation. Two tools are mounted in the rear slide and two in the front slide. In each case one tool is mounted directly over the other, the top tool being set slightly in advance and ground for maximum tool life, the bottom tool finishing the sides of each half. The front and rear slides are so timed that the rear slide is set one-half of the feed per revolution in advance of the front slide and thereby the total advance per each revolution is twice that of the feed used on each slide.